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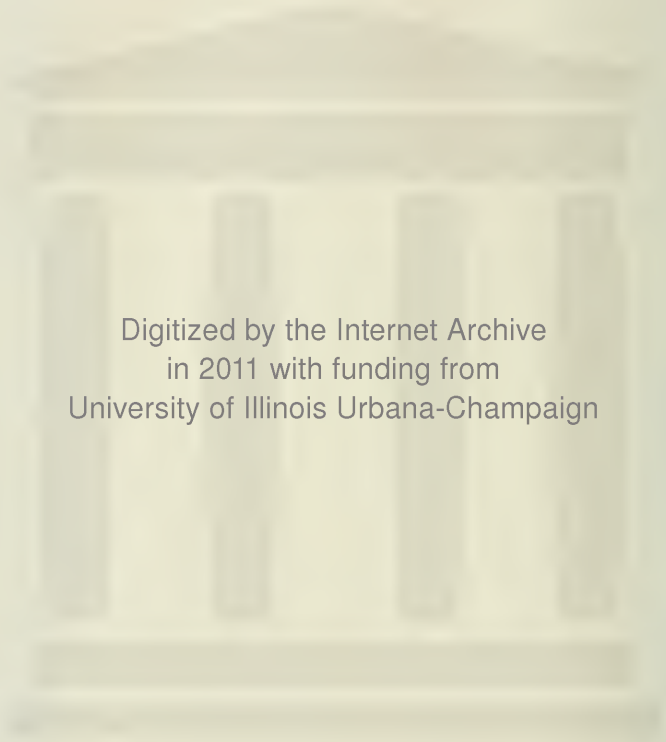
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Courses Catalog

**University
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UNIVERSITY OF ILLINOIS BULLETIN

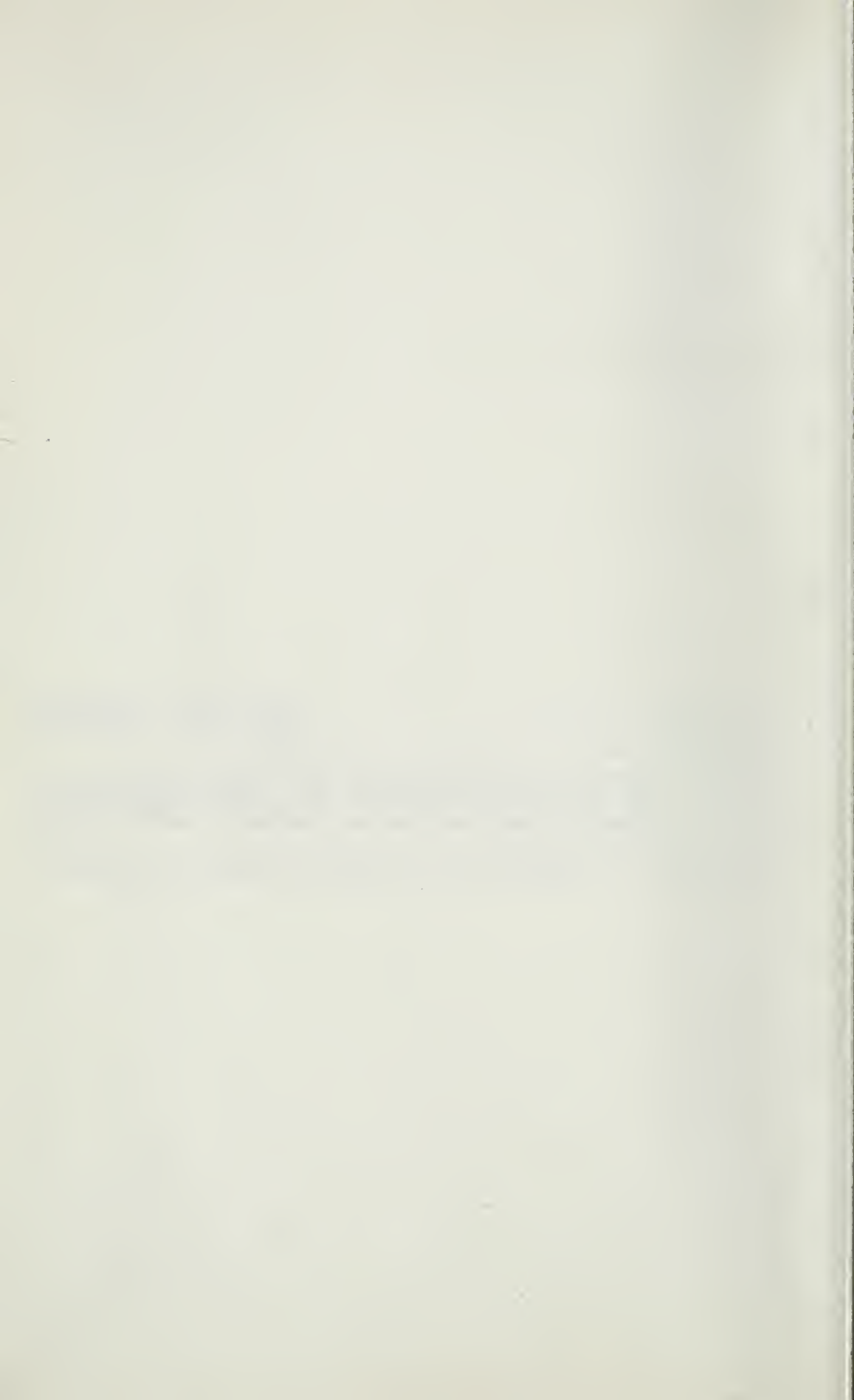
UNIVERSITY OF ILLINOIS BULLETIN

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1972/1974
Courses Catalog

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



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Courses Catalog

The following list of courses is arranged in alphabetical order by departments, and in numerical order within the departments. Courses for undergraduates (freshmen and sophomores) are numbered 100 through 199; for advanced undergraduates (juniors and seniors), 200 through 299; for advanced undergraduates and graduates (juniors, seniors, and graduates), 300 through 399; for graduate students only, 400 and above. An undergraduate must have thirty hours to be classified as a sophomore, a minimum of sixty hours to be classified as a junior, and a minimum of ninety hours to be classified as a senior.

Following the title of each course is a brief description of the content, the credit given, and the requirements for admission to the course, if any. Special requirements for admission to certain courses are introduced by the word prerequisite. Most, but not all, of these courses are offered at least once during the academic year.

Each department has available the undergraduate course number 199, Undergraduate Open Seminar. This is a special course for independent study or for experimentation, or a seminar on topics not treated by regularly scheduled courses. Requests for initiation of the course and suggestions of areas of study may be made by students; the course may also be initiated by a faculty member. The seminar may be offered with approval of the faculty member involved and the department head. Credit for the course shall apply toward graduation; credit toward satisfying particular college or departmental requirement is contingent upon approval by the appropriate college or departmental committee.

Credit for undergraduate students is counted in semester hours. A semester hour represents the work of one classroom period for fifty minutes each week through one semester (two periods per week in an eight-week summer session), or the equivalent in laboratory or field work or approved independent study. In description of courses, "3 hours" means three hours of credit each semester or summer session.

Credit for graduate students taking courses numbered 300 and above usually is counted in units. One unit is considered the equivalent of four semester hours of credit.

Undergraduate students wishing to enroll in courses numbered 300 and above for graduate credit or in 400-level courses for undergraduate credit must obtain the advance approval of the Graduate College.

Each undergraduate student is expected to pursue a normal program of studies; the number of hours required varies with the college and curriculum. More or less than a normal program may be permitted only the dean of the student's college or his representative. For eligibility for Dean's List recognition, the student must carry fourteen academic hours in a semester, excluding basic instruction courses in physical education (numbered 100 to 149); for participation in specified undergraduate student activities, the student must carry twelve hours a semester. Effective September 1, 1972, twelve credit hours and above (three units and above) in a semester comprise a full program of study for tuition and fee assessment; in an eight-week summer session the number of hours is six semester hours and above (one and one-half units and above).

For both undergraduate and graduate students, the minimum program required for selective service is twelve hours (or three units) in a semester and six hours (or one and one-half units) in an eight-week summer session. The same number of hours is required for receipt of maximum educational benefit payments under the Veteran's Readjustment Benefits Act of 1966 and for receipt of Social Security benefits as a dependent.

Detailed information relating to admission, costs, and graduation requirements is given in the Undergraduate Study and Graduate College catalogs.

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ACCOUNTANCY

Head of Department: Professor E. J. DEMARIS

Department Office: 360 Commerce Building (West)

101. **Principles of Accounting, I.** Basic accounting and business concepts; principles of recording business transactions; cash records and control; periodic adjustment of transaction data; financial statement presentations; relationship of accounting to business. 3 hours.
105. **Principles of Accounting, II.** Accounting and reporting principles of partnerships, corporations, branches, departments, and enterprises with incomplete records; interpretation of financial statements; basic valuation and cost concepts; control of manufacturing costs through product costing, process costing, standard costs; and budgeting. Prerequisite: Accountancy 101. 3 hours.
108. **Intermediate Accounting.** The functions, theory, and practice of accounting and its relationship to business management; the usefulness and limitations of accounting in providing information on financial activities, the acquisition of assets and services, the determination of income, and equity interests; features of internal control; the presentation, interpretation, and analysis of financial data and financial statements. Prerequisite: One year of accountancy; sophomore standing. 3 hours.
166. **Cost Accounting.** Use of costs for control and decision making with emphasis on standard costs, relevant costs, direct costing, non-manufacturing costs, and responsibility accounting. For students who have already studied the basic elements of job order and process costs and budgeting. Prerequisite: Accountancy 105. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Fundamentals of Accounting.** A survey course in the principles of accounting for non-commerce students. 3 hours.
203. **Business and Accounting Methods.** For students in professional curricula who will be confronted with accounting, tax, and business problems in connection with an independent practice. Not open to commerce students. Prerequisite: Junior standing. 2 hours.
206. **Cost Accounting for Engineers.** The elements of manufacturing costs and the influence of such cost and other accounting factors upon engineering design and production processes; and correlation of engineering and accounting concepts and procedures. Not open to students who have credit in Accountancy 101 or 201. Prerequisite: Junior standing in engineering. 3 hours.
208. **Elementary and Intermediate Accounting.** An accelerated course designed for students with advanced standing with no prior preparation in accounting, who desire to major in accountancy. Fundamentals of proprietorship, partnership, and corporation accounting. Consideration at the intermediate level of modern basic concepts of accounting theory; interpretation of financial statements, and analysis of the principal accounts represented therein. Prerequisite: Junior standing, a general University average of 3.5, or consent of head of department. 5 hours.
221. **Current Accounting Topics.** Consideration of authoritative pronouncements dealing with controversial problems of accounting practice. Prerequisite: Accountancy 308. 2 hours.
274. **Basic Federal Income Tax Accounting.** Basic discussion of history, theory, and outlines of federal income taxation for individuals, partnerships, and corporations, including the more important basic concepts involved in federal income taxation. Prerequisite: Accountancy 105. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the

honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.

308. **Advanced Accounting.** Reserves, sinking funds, actuarial methods, investments, partnerships, statements for special purposes, receiverships, consolidated balance sheets, foreign exchange. Prerequisite: Accountancy 166 and 108; an average of "C" or better in preceding courses in accountancy. 3 hours or 3/4 unit.
325. **Accounting System Design.** An introduction to the fundamentals of accounting system design. This includes the design and use of business papers, records, and reports; the functions of business machines in accounting systems; and personnel problems in accounting system design. Prerequisite: Accountancy 166; Computer Science 105 or equivalent. 3 hours or 3/4 unit.
341. **Governmental Accounting.** Accounts of institutions, municipalities, and of state and federal governments; organization, procedure, budget accounts and records, reports, audits. Prerequisite: Accountancy 108. 2 hours or 1/2 unit.
362. **Business Budgets and Accounting Control.** Procedures used in the preparation of business budgets and the principles underlying these procedures. A complete budget is prepared by the student for a typical manufacturing company. Prerequisite: Nine hours of accountancy, including Accountancy 166. 3 hours or 3/4 unit.
366. **Managerial Accounting and Quantitative Techniques.** Application of quantitative and mathematical techniques to managerial accounting problems including empirical methods, network techniques, probabilistic methods, linear algebra, sensitivity analysis, and other methods. Prerequisite: Accountancy 166; Economics 172; Mathematics 124. 3 hours or 3/4 unit.
367. **Managerial Accounting and Organizational Controls.** A study of managerial accounting and its functioning as an information subsystem, in relationship to the system of organization and the attainment of the goals of the enterprise. Stress is placed on the interactions of the components of the enterprise in response to information generated by the managerial accountant. Prerequisite: Accountancy 166; senior standing. 3 hours or 3/4 unit.
371. **Auditing.** Nature of audit evidence; basic audit techniques; audit practices and procedures; professional ethics; audit reports. Prerequisite: Accountancy 308. 3 hours or 3/4 unit.
372. **Auditing Problems and Cases.** Application of auditing principles in verification of financial statements; preparation of reports; case studies applicable to specific industries; current trends. Prerequisite: Accountancy 371. 3 hours or 3/4 unit.
374. **Advanced Income Tax Problems.** Practical and theoretical training in the more common and important provisions of the federal income tax, advanced problems, tax case research and preparation. Prerequisite: Senior standing; Accountancy 274 and 308. 3 hours or 3/4 unit.
377. **Advanced Problems.** Consolidated statements, foreign subsidiaries, insurance, estates, theory, general statements. Prerequisite: Senior standing; credit or registration in Accountancy 371. 3 hours or 1 unit.
378. **Advanced Theory and Practice.** Selected problems from C.P.A. examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; theory, auditing, ethics. Prerequisite: Accountancy 377. 3 hours or 1 unit.
432. **Accounting Under Different Social Systems.** An inquiry into the ways accounting has been adapted to the needs of different social systems; the extent of its contribution; its apparent limitations. Consideration is also given to the relationship between accounting and the growth and development of social systems. Prerequisite: Consent of instructor. 1 unit.
441. **State and Federal Accounting Theory.** Advanced study in accounting and other fiscal procedures of the federal government; state, county, and municipal governments; institutions. 1 unit.
455. **Macro-Accounting.** Same as Economics 425. An examination of the fundamental concepts underlying the attempts to measure the economic activities of macro-units; similar-

ities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macro-accounting statements and analyses; usefulness of macro-accounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macro-accounting theory or consent of instructor. 1 unit.

461. **Administrative Accounting.** Accounting as a tool for management; organization of accounting department, coordination of departmental operations, control of assets, control of operations, management audits, accounting aspects of coordinating the business with market conditions; cooperation with public accountants and government agencies, and social responsibilities. 1 unit.
462. **Management Accounting.** An examination of recent conceptual and analytical developments in the area of management accounting. The course includes a study of modern and relevant planning and control techniques and their underlying concepts as applied to the various functional areas within the firm. Prerequisite: An undergraduate course in management accounting. The student's background in statistics and mathematics should be equivalent to the undergraduate requirements of the University of Illinois College of Commerce and Business Administration in these areas. 1 unit.
466. **Cost Accounting Theory and Analysis.** A critical examination of cost accounting methods as to truth and expediency. 1 unit.
472. **Auditing Standards and Techniques.** A critical analysis of the techniques used in auditing; interrelation of audit standards, procedures, principles, and techniques; internal control as related to audit techniques; trends and developments in the accounting profession. 1 unit.
473. **The Theory of Accounting System Design.** Problems and procedures in connection with designing and installing accounting systems. 1 unit.
474. **Income Tax Development.** A theoretical and historical approach to the study of the development of federal income taxation, together with some research on tax cases and critical appraisal of the current law and proposals for its revision. 1 unit.
481. **Concepts and Principles.** The fundamental structure of accounting theory is developed through the study of concepts characteristic of accounting and an examination of the literature dealing with the concise formulation of accounting principles. 1 unit.
483. **Income Determination.** A study of the pros and cons of various unsettled issues involved in the calculation and disclosure of enterprise periodic income. 1 unit.
485. **Relationship of Accounting Theory to Philosophy, Science, and Other Disciplines.** An examination of the relationship of accounting theory to the developments, thoughts, and methods in the fundamental intellectual disciplines. 1 unit.
489. **History of Accounting Theory.** An examination of the more important aspects of accounting theory under the impact of changing conditions over four centuries, with major emphasis on the later developments. 1 unit.
493. **Special Research Problems.** Individual investigations or research projects selected by the students, subject to approval by the graduate adviser and the executive officer of the department. 1/4 to 2 units.
499. **Thesis Research.** Individual direction and guidance in writing theses, and seminar discussion of progress made. 0 to 4 units.
501. **Accounting Analysis, I.** Uses of account information; collection, processing, and communication of accounting information; measurement of assets, liabilities, equities, and income; accounting system design. 3/4 unit.
502. **Accounting Analysis, II.** An in-depth study of accounting valuation processes and accounting income measurement; special reporting problems of multiple-entity organizations; accounting for nonprofit organizations. Prerequisite: Accountancy 501 or equivalent. 3/4 unit.
503. **Managerial Accounting.** Introduction to management accounting as a part of firm's information system, in terms of modern cost accounting and budgetary systems for planning and controlling business operations. Prerequisite: Credit or registration in Accountancy 501 or equivalent. 1 unit.

504. **Taxation and Auditing.** Introduction to historical and conceptual material in specialized accounting areas of taxation and auditing. Emphasis centered on provisions of the tax law relevant to accounting measurement methods and on nature of evidence in auditing, auditing standards and techniques, and ethical constraints imposed on the auditor. Prerequisite: Accountancy 501 or 503, or equivalent. 1 unit.
566. **Accounting Problems of Industrial Management.** A development of the role and importance of cost and revenue data in the process of enterprise administration. Attention is focused on the goals of the firm and the possible aid in achieving these goals that would come from properly conceived, prepared, and utilized cost and revenue data. For Master of Accounting Science and Master of Business Administration students only. 1 unit.
577. **Professional Problems.** Instruction as to types and methods of solution of professional problems in public accounting, including practice in analyzing and solving a wide variety of such problems. For Master of Accounting Science students only. 1 unit.
594. **Methods and Practices in Professional Research.** Instruction in research methods, materials, and techniques together with individual practice in conducting and reporting on specific professional research projects. For Master of Accounting Science students only. 1 unit.

ADVERTISING

Head of Department: Professor S. W. DUNN

Department Office: 103a Gregory Hall

199. **Undergraduate Open Seminar.** 0 to 9 hours.
281. **Introduction to Advertising.** A survey of the economics, psychology, and philosophy of advertising; preparation of advertisements; selection of media; and organizational structure. 3 hours.
288. **Sales Writing.** Same as Rhetoric 271. Direct mail campaigns and company magazine copy. Prerequisite: Rhetoric 102 or equivalent. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in advertising for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours.
309. **Public Relations.** Publicity methods and public relations; representation of business and other sponsors to the public, and representation of the public to employers. Preparation of public relations units for the press and other media. Prerequisite: Senior standing in the College of Communications; consent of department. 3 hours or 1/2 unit.
381. **Advertising Research Methods.** Quantitative techniques and research methodology in advertising: philosophy of science, statistical methods, survey and experimental design, etc. Emphasis is on the problems of advertising research. Prerequisite: Advertising 281; a basic course in statistical methods; consent of department. 3 hours or 1/2 unit.
382. **Advertising Creative Strategy.** Theory and practice of advertising message planning and creation for print and broadcast media. Use of consumer and market surveys, copytesting methods, and advertising readership studies. Prerequisite: Advertising 281; consent of department. 3 hours or 1/2 unit.
383. **Advertising Media Policy and Strategy.** Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. Prerequisite: Advertising 281; consent of department. 3 hours or 1/2 unit.
384. **Advertising Campaigns.** Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget; organization and functions of advertising agency; choice of advertising appeals; selection of media; preparation of advertisements (copy and layout). Prerequisite: Advertising 382 and 383; consent of department. 3 hours or 1/2 unit.

387. **Advertising and Promotion Management.** Analysis of actual advertising situations and study of how such situations were or might have been met. Emphasis is given to management decision-making problems at the national level. Prerequisite: Advertising 281; consent of department. 3 hours or 1/2 unit.
388. **Advertising in Contemporary Society.** A study of advertising as an institution and its role in communications, society, our economy, and business. Students are not given graduate credit for both Advertising 388 and 481. Prerequisite: Advertising 281; senior standing; consent of department. 2 hours or 1/2 unit.
389. **International Advertising and Promotion.** The role of advertising and promotion in international communication and economic development; behavioral science approach to international communications strategy; comparative analysis of advertising and promotion systems. Prerequisite: Advertising 281; senior standing; consent of department. 3 hours or 1/2 unit.
390. **Advanced Creative Strategy.** Advanced work in application of behavioral science and creative process to planning and writing of advertisements. Prerequisite: Advertising 382; consent of department. 2 hours or 1/2 unit.
481. **Economic and Social Aspects of Advertising.** Same as Communications 481. An examination of advertising as an institution; the economic, social, and legal aspects of advertising with focus on current problems. Students may not receive graduate credit for both Advertising 481 and 388. Prerequisite: Consent of department. 1 unit.
482. **Research Methods in Advertising and Communications.** Same as Communications 482. A treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications. Both nonquantitative and quantitative methods are examined. Prerequisite: A basic course in statistical methods. 1 unit.
484. **Advertising and Consumer Behavior.** An examination of consumer behavior as a means of shaping the communications message; use of the behavioral sciences in creative communication strategy. Prerequisite: Consent of department. 1 unit.
485. **Advertising Planning and Decision Making.** An examination of the theoretical foundations of decision theory as they relate to planning and decision making in advertising; use of decision models in the development of strategies and tactics. 1 unit.
490. **Special Topics in Advertising.** 1/2 or 1 unit. Prerequisite: Consent of head of department.
499. **Thesis Research.** 1 to 2 units.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

Head of Department: Professor H. S. STILLWELL

Department Office: 101 Transportation Building

199. **Undergraduate Open Seminar.** 0 to 9 hours.
212. **Aerodynamics, I.** Quasi-one-dimensional flow; conservation of mass, momentum, and energy; steady flow with variable area; steady, constant area flow with friction, heat addition, and mass injection; shock waves, non-steady, one-dimensional flows; two-dimensional flow; oblique shock waves and Prandtl-Meyer waves. Prerequisite: Mechanical Engineering 207; Theoretical and Applied Mechanics 156; credit or registration in Mathematics 343. 4 hours.
213. **Aerodynamics, II.** Equations of motion for a viscous, heat conducting fluid; exact solutions of the Navier-Stokes' equations; boundary layer theory; inviscid approximations, vorticity, and circulation; potential flow; solutions of the potential flow equations, sources, sinks, Prandtl-Meyer flow; thin airfoil and slender body theory; method of characteristics. Prerequisite: Aeronautical and Astronautical Engineering 212. 4 hours.
224. **Flight Structures, I.** Development of fundamental concepts of elasticity as related to

- stress, strain, equilibrium, compatibility, and material properties. Applications to flight vehicle structural problems in unsymmetric bending, torsion, thick walled cylinders, rotating discs; shear flow and shear center problems. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 156. 4 hours.
225. **Flight Structures, II.** Energy concepts with applications to indeterminate flight structures, sandwich beams, and shear flow; elastic and plastic buckling of columns and plates; membrane theory of shells. Prerequisite: Aeronautical and Astronautical Engineering 224. 4 hours.
233. **Aircraft Propulsion.** Study of current and projected aircraft power plants and propulsion systems from the standpoint of operation, efficiencies and construction; fuels and fuel systems; ignition; combustion; air compression. Prerequisite: Aeronautical and Astronautical Engineering 212. 3 hours.
241. **Flight Vehicle Design.** Introduction to preliminary design of airplanes, missiles, and space vehicles; further development of concepts in orbital mechanics, hypersonic aerodynamics, and aerodynamic heating. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255; Computer Science 101. 3 hours.
254. **Aerospace Dynamic Systems, I.** Aerospace system components, block diagrams; single degree of freedom dynamic and linear feedback control systems; Laplace transforms, time domain, and frequency response techniques; the characteristic equation and stability criteria; introduction to inertial guidance and analog computers. Prerequisite: Mathematics 345 or 349. 3 hours.
255. **Aerospace Dynamic Systems, II.** Hamilton's principle and Lagrange equation; fundamentals of orbital mechanics, trajectory optimization; multiple degrees of freedom; dynamic systems and continuous elastic structures; divergence and flutter of lifting surfaces; flight vehicle performance, stability, and control; large disturbance maneuvers. Prerequisite: Aeronautical and Astronautical Engineering 254. 4 hours.
260. **Aerospace Laboratory, I.** Theory and application of experimental techniques in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255. 2 hours.
263. **Aerospace Laboratory, II.** Design of experiments and application of the various measurement techniques to investigations in aeronautical and astronautical engineering. Special projects may be undertaken by selected students. Prerequisite: Aeronautical and Astronautical Engineering 260. 2 hours.
271. **Principles of Automatic Control.** Steady-state and dynamic properties of servo-mechanisms and feedback control systems. Block diagrams and system equations. Laplace transforms; frequency-response techniques. The characteristic equation, stability criteria, and compensation techniques. Introduction to analog computers and inertial navigation. Prerequisite: Mathematics 345 or 349. 3 hours.
292. **Seminar.** Reports and discussions of recent developments in the fields of aerodynamics, flight mechanics, power plants, structures, and maintenance and operations as related to airplanes, missiles, and space vehicles. Prerequisite: Senior standing. 1 hour.
296. **Honors Project.** A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
303. **The Effect of Space Environment on Satellite Motion.** Free molecule aerodynamics; gravity gradient and solar radiation torques on satellites; interaction of on-board magnetic dipoles with the Earth's magnetic field; solar wind; cosmic dust and micro-meteoroid torques; lifetime problem and density determination; utilization of these various environmental effects in satellite attitude control. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or 3/4 or 1 unit.
306. **Foundations of Mechanics, and Gravitational Theory.** Same as Astronomy 306. Introduction to the dynamics of particles and of rigid bodies with special emphasis on

elementary planetary motion, motion of a rocket, motion of long-range projectile relative to earth, precession of earth's axis. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.

311. **Aerodynamics of Compressible Fluids.** Methods of solution of fluid flow problems in subsonic, transonic, and supersonic flight regimes. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or 3/4 or 1 unit.
313. **Aerodynamics of Incompressible Fluids.** Governing equations for incompressible flow; vorticity, circulation, Kelvin and Helmholtz's theorems; velocity potential and stream function; three-dimensional steady and non-steady flows, d'Alembert's paradox, apparent mass; two-dimensional steady flows, complex potential and velocity, mapping of flows; 2-D airfoils, Joukowski transformation and airfoils; thin airfoil theory. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 3 hours, or 3/4 or 1 unit.
314. **Aerodynamic Heat Transfer.** Thermal boundary layers; turbulent heat transfer; aerodynamic heating; radiative heat transfer. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or 3/4 or 1 unit.
316. **Atmospheric Flight Performance.** Aerodynamics of flight; lift and drag analysis; performance, analysis of lifting and non-lifting vehicles. Prerequisite: Aeronautical and Astronautical Engineering 213 and 233, or consent of instructor. 3 hours, or 3/4 or 1 unit.
317. **Elements of Magnetohydrodynamics.** Same as Astronomy 317. Equations of magnetohydrodynamics, single-fluid models, magnetic interaction parameters, magnetosonic waves, hydromagnetic shock waves, aligned-field and crossed-field flows, theory of characteristics, MHD acceleration, generation, and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit.
326. **Theory of Continuous Media.** Introduction to the general theory of continuous media and its application to the theories of elasticity, fluid mechanics, and inelasticity. Stress and strain tensors and their invariants; nonlinear strain relations; nonlinear equilibrium conditions; the mechanism of deformation of single crystal and polycrystalline media; basic concepts of the structure of matter; thermodynamic considerations; equations of state and stress-strain relationships with applications. Prerequisite: Consent of instructor. 3 hours or 1 unit.
327. **Thermal Stresses and Creep Buckling.** Structural effects of aerodynamic heating; analysis of thermal stresses in elastic, viscoelastic, and plastic media; effect of temperature dependent material properties on thermal stresses; analytical studies of creep buckling due to axial loads and heating of plastic and linear and nonlinear viscoelastic columns, plates, and shells; life expectancy of structures under elevated temperatures; minimum weight and probability of failure; applications to high-speed airplane, missile, and space vehicle structures. Prerequisite: Aeronautical and Astronautical Engineering 326 or consent of instructor. 3 hours or 1 unit.
331. **Properties of Gases.** The fundamental principles of kinetic theory and of classical and statistical thermodynamics are reviewed as a basis for treating gas imperfection, dissociation, chemical reactions, ionization processes, transport properties, and relaxation phenomena. With this base, the fundamental equations of reactive flow are derived and applied to the description of quasi one-dimensional nozzle flow and shock wave structure. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours or 3/4 unit.
333. **Electric Propulsion.** Elements of propulsion as applied to deep space missions. Physics of ionized gases; plasmadynamics; electrothermal, electromagnetic, and electrostatic acceleration of gases to high velocity; high-impulse thruster design and performance; the resistojet, arcjet, ion engine, MPD arc, and plasma gun. 3 hours or 1 unit.
334. **Rocket Propulsion and Rocketry.** The basic principles of rocket propulsion and rocketry are treated. Propellants and their influence on design of rockets, internal and external ballistics, combustion processes, design of components, guidance problems, flight performance and rocket testing are discussed in detail. Prerequisite: First course in thermodynamics or consent of instructor. 3 hours or 1/2 unit.
351. **Aeroelasticity and Aeroinelasticity.** Advanced fundamental treatment of aerodynamic

and dynamic structural phenomena associated with flexible airplanes and missiles; divergence of linear and nonlinear elastic lifting surfaces; effect of elastic and inelastic deformations on lift distributions and stability; elastic flutter of straight and swept wings; equations of disturbed motion of elastic and inelastic aircraft; dynamic response to forces, gusts, and continuous atmospheric turbulence; creep divergence of lifting surfaces; flutter in the presence of creep; effect of temperature on inelastic divergence and flutter. Prerequisite: Aeronautical and Astronautical Engineering 255. 3 hours or 1 unit.

391. **Special Problems.** Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. Prerequisite: Senior standing in engineering; consent of instructor. 2 to 4 hours, or 1/2 or 1 unit.
414. **Boundary Layer Theory.** Theories of the boundary layer of a compressible fluid and their solutions, laminar and turbulent; boundary layer in hypersonic flow. Prerequisite: Aeronautical and Astronautical Engineering 213. 1 unit.
415. **Wing Theory.** Theoretical analysis of the aerodynamic characteristics of two- and three-dimensional wings and multiple body systems in subsonic and supersonic flow. Prerequisite: Mathematics 346 or equivalent. 1 unit.
416. **Hypersonic Aerodynamics.** Discussion of high Mach number flows including the aerodynamic effects of dissociation and ionization. Prerequisite: Aeronautical and Astronautical Engineering 411. 1 unit.
417. **Fundamentals of Gas Kinetics.** Fundamental concepts required to study gas theory: derivation of the Boltzmann equation from classical mechanics; reduced and truncated distribution functions and the BBGKY hierarchy; molecular collisions; flux vectors, equations of change; moment equations; summational invariants; H-theorem and Maxwellian distribution; inclusion of the effect of solid surfaces in kinetic theory; existence theory for the Boltzmann equation; iteration procedures; moment methods; Chapman-Enskog procedure; first and second approximations to the distribution function, the heat flux vector, and stress tensor. Prerequisite: Aeronautical and Astronautical Engineering 213. 1 unit.
418. **Theory of Rarefield Gas Flows.** Application of kinetic theory to rarefield gas flow problems; free-molecule flow; near free-molecule flow; linearized problems; flows with appreciable deviation from equilibrium. Prerequisite: Aeronautical and Astronautical Engineering 417 or Physics 362. 1 unit.
428. **Theory of Large Deformations in Nonlinear Continuous Media.** Fundamental concepts of large deformations in nonlinear elasticity and inelasticity with applications; generalized tensors, finite deformations, stress-strain relations in terms of strain energy functions, solutions of tension, shear and bending problems, finite plane strain, theory of successive approximations, fiber reinforced beams, plates and cylinders, thermodynamics of deformable media, stability considerations, constituent relations for inelasticity. Prerequisite: Aeronautical and Astronautical Engineering 326 or equivalent. 1 unit.
429. **Theory of Linear and Nonlinear Viscoelasticity.** Same as Theoretical and Applied Mechanics 429. Fundamental concepts of viscoelasticity with applications. Elastic-viscoelastic analogies, creep and relaxation functions, thermo-mechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, torsion of nonlinear bars and shells. Prerequisite: Aeronautical and Astronautical Engineering 326 or consent of instructor. 1 unit.
434. **Aerodynamic Heating.** Theory of convective aerodynamic heating in high-speed flow, laminar and turbulent flows; ablation, transpiration cooling, and mass transfer cooling; aerodynamic heating in hypersonic flow, real gas effects, effect of pressure interactions and vorticity interactions; heat transfer in rarefied gas flows. Prerequisite: Aeronautical and Astronautical Engineering 414 or equivalent. 1 unit.
438. **Fundamentals of Combustion.** Same as Mechanical Engineering 403. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames,

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their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; supersonic burning. Prerequisite: Aeronautical and Astronautical Engineering 213 or Mechanical Engineering 305. 1 unit.

- 452. Stochastic Structural Dynamics.** Same as Theoretical and Applied Mechanics 417. Linear structural dynamics problems treated from a probabilistic point of view; axiomatic probability theory and random processes; the response of linear structures to random excitation; practical problems in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 255 or Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
- 453. Stochastic Processes in Engineering.** Same as Electrical Engineering 438 and Theoretical and Applied Mechanics 418. Supplementing Aeronautical and Astronautical Engineering 452, Electrical Engineering 434, or Theoretical and Applied Mechanics 417 for additional engineering application of stochastic processes. Theories of random pulses and continuous Markov processes and their applications to dynamic and control systems; parametric excitations and stability; nonlinear devices; topics related to system failures. Prerequisite: Aeronautical and Astronautical Engineering 452, Electrical Engineering 434, Theoretical and Applied Mechanics 417, or equivalent. 1 unit.
- 490. Seminar.** Presentation by graduate students and staff of current topics in the fields of aeronautics. Prerequisite: Graduate standing in aeronautical and astronautical engineering. 0 credit.
- 493. Special Problems.** Theoretical and experimental investigations of problems in airplane, missile, and space flight engineering. 1 to 2 units.
- 499. Thesis Research.** Research in the various areas of the aeronautical and astronautical sciences. 0 to 4 units.

AFRICAN STUDIES

Chairman of African Studies Program: Professor V. C. UCHENDU

Program Office: Room 101, 1208 West California Avenue, Urbana

This program is sponsored and administered by the African Studies Program. Students in all colleges and schools of the University who desire a knowledge of African affairs and cultures are invited to consult, either directly or through their advisers, with the chairman and faculty associated with the program in order to develop course programs suited to their individual needs and objectives.

- 201. Elementary Swahili, I.** Same as Swahili 201. Beginning spoken Swahili with minimum of formal grammar. Conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.
- 202. Elementary Swahili, II.** Same as Swahili 202. Second semester of spoken Swahili. More conversation with a native tutor. Further grammar. Prerequisite: African Studies 201. 5 hours.
- 205. Elementary Yoruba, I.** Same as Yoruba 201. An introduction to Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor, and essentials of formal grammar. All students are required to register for 3 hours per week in the language laboratory. 5 hours.
- 206. Elementary Yoruba, II.** Same as Yoruba 202. Second term of spoken Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor. Further formal grammar based on conversational materials. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: African Studies 205 or consent of instructor. 5 hours.

222. **Introduction to Modern Africa.** Same as Anthropology, Political Science, and Sociology 222. An interdisciplinary, introductory course to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
303. **Intermediate Swahili, I.** Same as Swahili 303. Second-year Swahili with emphasis on developing conversational fluency. Some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as Swahili 304. More of second-year Swahili with emphasis on conversational fluency. Some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.
307. **Intermediate Yoruba, I.** Same as Yoruba 303. Continued study of Yoruba grammar with emphasis on developing conversational fluency; readings on Yoruba culture and current affairs. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: African Studies 206 or consent of instructor. 5 hours or 1 unit.
308. **Intermediate Yoruba, II.** Same as Yoruba 304. Concentrates on attaining conversational fluency. Further readings in Yoruba newspapers and magazines and simpler portions from contemporary Yoruba plays and novels. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: African Studies 307 or consent of instructor. 5 hours or 1 unit.

AGRICULTURAL ECONOMICS

(Including Rural Sociology)

Head of Department: Professor R. L. FELTNER

Department Office: 304 Mumford Hall

Agricultural Economics

100. **Introductory Agricultural Economics.** Principles of production, supply, and demand applied to economic problems of agriculture and agriculturally related industries and to decisions in farm management, marketing, foreign trade, and agricultural policy; the role in economic growth of natural resources, population, and capital. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Problems in Agricultural Economics.** Individual research work under the supervision of senior members of the staff in the following fields: agricultural credit and finance; agricultural law; agricultural marketing; agricultural policy; agricultural prices; farm management; land economics; rural organization; statistical analysis. Students may receive credit for research in preparing for intercollegiate debating and speaking on problems in agricultural economics when such opportunities exist. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval is required prior to advance enrollment and registration. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
203. **Farm Taxation.** Federal, state, and local taxation with emphasis on the application to farm income, farm property, farm property transfers, and agricultural cooperatives. Introductory material on the uses and sources of revenue. 2 hours.
220. **Farm Management.** Economic principles applied to the organization and operation of farms; complete and partial budgeting; crop and livestock systems; farm record analysis; farm financial management; and types of farm leases. Problem involving resource

- appraisal and reorganization of enterprises for the home farm. Field trips; estimated cost, \$3.00. Prerequisite: Agricultural Economics 100 or Economics 108. 3 hours.
230. **Marketing of Agricultural Products.** Nature of the production, the marketing system, and the market for farm products; functions and services performed; selected and general problems in pricing major commodities, in choosing outlets, and expanding the market. Field trip; estimated cost, \$3.00 or less. 3 hours.
273. **Recreation in Rural Areas.** Same as Recreation 273. Growth and development of recreation in rural areas; leadership development; agencies; types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, \$15.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours.
301. **Economics of Agricultural Development.** The economics of agricultural development and the relationships between agriculture and other sectors of the economy in developing nations; agricultural productivity and levels of living in the less developed areas of the world; studies of agricultural development in different world regions including Africa, Asia, and Latin America. Prerequisite: Economics 103 or 108. 3 hours, or 3/4 or 1 unit.
302. **Financing Agriculture.** Capital and credit needs of farmers, agencies supplying credit; problems of borrowers and lenders. Prerequisite: Economics 103 or 108. 3 hours, or 3/4 or 1 unit.
303. **Agricultural Law.** Relation of common-law principles and statutory law to land tenure, farm tenancy, farm labor, farm management, taxation, and other problems involving agriculture. Prerequisite: Senior standing or consent of instructor. 3 hours, or 3/4 or 1 unit.
305. **Agricultural Policies and Programs.** The problems of agriculture as an industry and analysis of past and current federal and state governmental policies and programs affecting agriculture; objectives and development of policies; the use of economic concepts in evaluating possible future agricultural policies and programs; and forces in policy formation. Field trip; cost, \$10.00. Prerequisite: Economics 108. 3 hours, or 3/4 or 1 unit.
312. **Farm Appraisals.** Same as Agronomy 312. Valuation methods and value bases of farm real estate. Includes legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agroeconomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, \$10.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, 3/4 or 1 unit).
318. **Land Economics.** Physical economic and institutional factors that affect the role of land in economic life, population and resource requirements, principles of land utilization, returns from land, land value, property rights and tenure rights, social controls, rural and urban land development. Prerequisite: For undergraduates, Economics 103 or 108; for graduates, consent of instructor. 3 hours, or 3/4 or 1 unit.
324. **Farm Operation.** Operating costs in farming, analysis of farm jobs, farm work simplification, selecting power units and equipment for economical operation. Field trips; estimated cost, \$5.00. Prerequisite: Agricultural Economics 220. 3 hours, or 3/4 or 1 unit.
325. **Advanced Farm Management.** The functions of management; effects of goals and values on management decision; use of economic analysis in farm production planning, including resource allocation and valuation, and cost minimization. Prerequisite: Agricultural Economics 220. 3 hours, or 3/4 or 1 unit.
326. **Professional Farm Management.** Principles of farm management applied to the problems of those managing farms for others as a profession; development of the profession; relationships with clients and farm operators; division of inputs and returns between owner and operator; direct operation of farms with hired labor; case problems; business practices and procedures; professional ethics. Field trips to farms and professional farm management offices; estimated cost, \$25.00. Prerequisite: Credit or registration in Agricultural Economics 324; Agricultural Economics 325. 3 hours, or 3/4 or 1 unit.
331. **Grain Marketing.** Economic and marketing problems in grain; the utilization of grain;

pricing arrangements for grain, especially futures markets; inventory management; operational problems at country and interior points; factors affecting grain prices; seasonal variation in grain prices. Field trips required; estimated cost, \$10.00. Prerequisite: Agricultural Economics 230 or an elementary marketing course. 3 hours, or 3/4 or 1 unit.

332. **Livestock Marketing.** Same as Animal Science 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; evaluation of changes in the industry affecting marketing decisions. Field trip; estimated cost, \$15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or 3/4 or 1 unit.
334. **Marketing of Dairy Products.** Same as Dairy Science 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, markup laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; expanding markets for dairy products. Inspection trip; estimated cost, \$5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or twelve hours of dairy science or dairy technology. 3 hours, or 3/4 or 1 unit.
335. **Economics of Food Distribution.** Same as Horticulture 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; (c) consumer demand for food. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or 3/4 or 1 unit.
337. **Economic History of American Agriculture.** Same as Economics and History 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college level course in basic economics or American history. 3 hours, or 3/4 or 1 unit.
338. **Agribusiness Management.** Fundamentals in demand analysis, forecasting, budgeting, investing, locating facilities, financing, pricing, and merchandising in agricultural businesses; practice in decision-making using computer game and case problems of firms. Prerequisite: Accountancy 101 or 201; Economics 102 or 108. 3 hours or 3/4 unit.
340. **Commodity Futures Markets and Trading.** Development of futures trading; operation and governance of commodity exchanges; economic functions of futures trading; operational procedures and problems in using futures markets; public regulation of futures trading; developmental problems. Field trips required; estimated cost, \$25.00. Prerequisite: Economics 103 or 108. 3 hours or 3/4 unit.
341. **Agricultural Economic Statistics.** Graphic presentation, frequency distribution, inference and probability, time series analysis, index numbers, analysis of variance, correlation, and simple and multiple regression as applied to agricultural economics. Prerequisite: Mathematics 111 or 112, or equivalent. 3 hours, or 3/4 or 1 unit.
342. **Agricultural Prices.** A study of the factors affecting prices of agricultural products; longtime cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products and problems in price analysis and forecasting. Prerequisite: Economics 103 or 108. 3 hours, or 3/4 or 1 unit.
352. **Economic Development in Latin America.** Same as Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit.
353. **Economic Development in India and Southeast Asia.** Same as Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit.
354. **Economic Development of Tropical Africa.** Types of African economies and growth of

the exchange economy. Development of natural resources, industry, trade, finance, and education. Analysis of economic integration, governmental planning, and development projects. Demographic land tenure, and institutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit.

- 370. Family Economics.** Same as Home Economics 370. Economic welfare of American families in terms of cost of living, standards of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or 3/4 or 1 unit.
- 401. International Comparative Agriculture.** Agricultural and food problems of the world and of selected countries viewed in the world setting; resources and institutional factors affecting production; national and international policies and plans for developing agricultural production and improving levels of living. Emphasis is given to a comparative approach to agricultural development of countries on different economic levels. 1 unit.
- 404. Economics of Agricultural Production.** Evaluation of efficiency in the use of agricultural resources; production relationships within the farm; adaptation of the farm business to uncertainty; production relationships among farms; location of agricultural production. Prerequisite: Economics 300 and Agricultural Economics 341 or consent of instructor. 1 unit.
- 405. Economic Policies and Programs Affecting Agriculture.** Economic analysis of state, national, and international policies and programs, including proposed legislation having important bearing on the well-being of farm people. Prerequisite: One semester of graduate work or consent of instructor. 1 unit.
- 406. Research Methodology in Agricultural Economics.** Methods of inquiry leading to information which is reliable and relevant to the solution of problems significant in the agricultural economy. Prerequisite: Economics 400 or 401, or a course of comparable level in the basic field related to the student's research. 1 unit.
- 425. Farm Management Principles.** Analysis of farm business records; evaluation of measures of efficiency; planning the cropping system for increased income and control of erosion; use of economic information in fitting livestock to the farm plan; efficient use of labor and power; special research problems in farm organization. 1 unit.
- 436. Problems in Marketing Agricultural Products.** Factors influencing growth of markets; methods of reducing costs and improving marketing processes; activities of government agencies; cooperative efforts. 1 unit.
- 441. Agricultural Statistics.** Sources and methods of collection and analysis of prices and other agricultural statistics; trend fitting, linear and curvilinear multiple correlation, analysis of variance and sampling. Prerequisite: An elementary course in statistics. 1 unit.
- 442. Agricultural Price Analysis.** A study of the methods used to analyze factors affecting agricultural prices; analysis of agricultural prices and price movements with respect to time, space, and form; methods of price forecasting; role of public and private institutions in price setting. Prerequisite: Economics 300 and Agricultural Economics 341, or equivalent. 1 unit.
- 470. Seminar in Family and Consumption Economics.** Same as Home Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 102 or 108 and a course in statistics; Agricultural Economics 370 or consent of instructor. 1/2 or 1 unit.
- 491. Seminar and Special Topics.** All graduate students majoring in agricultural economics must register in the noncredit section of this course. In addition, students may register for credit for individual research or group instruction on special topics under the supervision of one or more staff members. 0 to 2 units.
- 499. Thesis Research.** Individual research under supervision of members of the graduate teaching staff in their respective fields. 0 to 4 units.

Rural Sociology

117. **Introduction to Rural Sociology.** Principles of rural-urban sociology with examples and illustrations from rural society; basic concepts for analysis of sociological data on culture, ecology, population, groups, institutions, and social processes. 3 hours. No credit is allowed for students with credit in Sociology 100.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
270. **Population and Human Ecology.** Same as Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories and human ecology and current problems. Prerequisite: Sociology 100 or Rural Sociology 117; junior standing. 3 hours.
277. **Rural Social Change.** Same as Sociology 277. Social forces retarding or accelerating change—traditions, beliefs, attitudes, innovations, social movements, social planning—as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed \$5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.
343. **Social Change in Developing Areas.** Same as Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies. Special attention is given to problems of traditional social structure undergoing modernization. Social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, and family and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or 1/2 or 1 unit.
378. **Socio-Cultural Factors in African Economic Development.** Same as Anthropology 378. An examination of the African "development environment" and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
407. **Population Studies and Demographic Analysis.** Same as Sociology 407. Nature and development of population theories; population growth and measures of fertility, reproduction, mortality, morbidity, and internal migration; indices, rates, and standardizations used in analyzing compositional characteristics. Methods in population projections; relationship of economic, sociological, and psychological factors to population changes. Prerequisite: Twelve hours of social science and introductory statistics, or major in sociology, or consent of instructor. 1 unit.
477. **Seminar on Community Organization.** Same as Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
487. **Special Problems in Rural Sociology.** Same as Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. 1/2 or 1 unit.

AGRICULTURAL ENGINEERING

(Including Agricultural Mechanization)

Head of Department: Professor F. B. LANHAM

Department Office: 245 Agricultural Engineering Building

Agricultural Engineering

126. **Engineering in Agriculture, I.** Consideration of the role of the agricultural engineer in the development of agricultural production facilities; resources for production; material

and equipment performance characteristics; livestock production systems; analysis of system constraints. Prerequisites: Mathematics 120; credit or registration in Physics 106. 3 hours. HALL.

127. **Engineering in Agriculture, II.** Continuation of Agricultural Engineering 126. Field equipment performance characteristics; analysis of machinery systems constraints; elementary design of equipment systems using concepts of uncertainty, modeling, and optimization. Prerequisite: Agricultural Engineering 126. 3 hours. HUNT.
199. **Undergraduate Open Seminar.** 0 to 5 hours.
236. **Machine Characteristics and Mechanisms.** Design and development concepts of agricultural and industrial machines. Analysis and synthesis of tillage, planting, harvesting, and material handling mechanisms. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 211; credit or registration in Computer Science 101. 3 hours. HOAG.
277. **Design of Concrete and Steel Structures for Agriculture.** Design of steel and concrete structures as applied to farm buildings and soil and water engineering structures. Prerequisite: Credit or registration in Civil Engineering 261. 3 hours. CURTIS.
287. **Environmental Control for Plants and Animals.** Application of engineering and biological principles to the art and science of controlling environments for productive animals, plants, and their products. Methods for maintaining environments to meet specific biological requirements are investigated through the integration of engineering principles for environmental control with the thermodynamic properties of animals, plants, and their related biological needs. Prerequisite: Agricultural Engineering 126 and 127. 3 hours. SHOVE.
296. **Honors Project.** A special problem in engineering is selected for biological and theoretical and/or experimental research. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours. YOERGER.
298. **Undergraduate Seminar.** Professional engineering concepts; relationship of agricultural engineering to other engineering and agricultural disciplines; preparation and presentation of an undergraduate thesis proposal. Thesis to be completed in Agricultural Engineering 299. Three-day field trip. Prerequisite: Junior standing in engineering. 1 hour. LANHAM.
299. **Undergraduate Thesis.** The agricultural engineering problem selected in Agricultural Engineering 298 is investigated and a detailed engineering report prepared. Prerequisite: Agricultural Engineering 298; senior standing in engineering. 2 to 4 hours.
311. **Instrumentation and Measurements.** Same as Mechanical Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or 3/4 or 1 unit. HOAG.
336. **Design of Agricultural Machinery.** Determining machine requirements and specifications, design layout, effective use of materials and shapes, relation of design to problem. Prerequisite: Agricultural Engineering 236; Credit or registration in Mechanical Engineering 224. 3 hours or 3/4 unit. BUTLER.
340. **Introduction to Applied Statistics.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or 3/4 unit. SEIF.
346. **Tractors and Prime Movers.** Engineering aspects of design and application of tractors for farm, construction, and military use. Thermodynamics of engines, turbines, and other power units. Measurement of power and efficiencies, transmission of power, traction, stability, and hydraulic circuitry. Prerequisite: Mechanical Engineering 209. 3 hours or 3/4 unit. WEBER.
348. **Air Pollution Seminar.** Same as Civil Engineering, General Engineering, Geography,

- Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects and economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
356. **Soil Conservation Structures.** Hydrology, hydraulics, design, construction, and cost estimating of soil and water conservation structures; relationship of slopes, soils, crops, and practices in soil conservation and flood control. Prerequisite: Theoretical and Applied Mechanics 235; Agricultural Engineering 277 or equivalent. 3 hours or 3/4 unit. LEMBKE.
357. **Land Drainage.** The design, construction, performance, and maintenance of surface, tile, and open ditch drainage systems. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours or 3/4 unit. JONES.
387. **Agricultural Process Engineering.** Principles, design factors, equipment, and controls of systems for drying, refrigerating, reducing, pelleting, blending, cleaning, sorting, and treating agricultural crops and products. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or 3/4 unit. SHOVE.
396. **Special Problems.** Individual investigation and report of any phase of agricultural engineering approved by the department. Prerequisite: Senior standing in engineering. 1 to 4 hours, or 1/4 to 1 unit.
400. **Research Orientation.** Discussion of the philosophy and methods of research, thesis preparation, and publication of research findings. 0 credit.
436. **Dynamics of Farm Machine Elements.** Advanced study of the dynamics of farm machine elements with specific reference to functional operation, stresses, and fatigue life. Prerequisite: Agricultural Engineering 236 and 336, or equivalent. 1 unit. YOERGER.
440. **Design and Analysis of Biological Experiments.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Agricultural Engineering 340 or equivalent. 3/4 unit.
441. **Advanced Design and Analysis of Biological Experiments.** Same as Agronomy 441. Design and analysis of complex experiments. Confounded factorials, lattice designs, and other incomplete-block experiments are considered from the view point of their characteristics, methods of analysis, and usefulness in biological research. Prerequisite: Agricultural Engineering 440 or equivalent. 1/2 unit.
446. **Dynamics of Tillage, Traction, and Earthmoving.** Relationship of soil parameters to forces acting on tillage tools, earthmoving components, and traction devices; stress-strain relationships in soil, failure patterns, and pulverization; speed effects, energy requirements, power trains, and model simulation. Prerequisite: Bachelor of Science degree in engineering or consent of instructor. 1 unit. WEBER.
490. **Seminar.** Presentation and discussion of current research and literature in agricultural engineering. 1/4 unit.
496. **Problems in Agricultural Engineering.** Investigation and report on problems in farm machinery, farm power, rural electrification, soil and water control, rural housing and farm structures. Prerequisite: Consent of head of department. 1 unit.
499. **Thesis Research.** 0 to 4 units.

Agricultural Mechanization

100. **Engineering Applications in Agriculture.** Examples, problems, discussion, and laboratory exercises pointing to present and potential engineering applications in agriculture. Emphasis is placed on farm power and machinery, soil and water control, farm electrifi-

cation, and farm structures. Prerequisite: Mathematics 104, 111, 112, or equivalent. 3 hours. RODDA.

199. **Undergraduate Open Seminar.** 1 to 5 hours.

200. **Agricultural Mechanics Shop: Construction Technology.** Selection, use, and maintenance of hand and power tools; shop safety, selection of building and roofing materials; concrete and concrete masonry construction; crop and machinery storage; livestock housing; farm leveling and erosion control structures. A special ten-week course for students majoring in vocational agriculture who are enrolled in off-campus student teaching. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours. ESPENSCHIED.

201. **Agricultural Mechanics Shop: Electrical and Metalwork.** Selection and application of electrical wiring, materials, controls, and electric motors to agricultural lighting, heating, ventilating, and materials handling problems; metalworking and heat treating; plumbing; selection and use of electric arc, inert gas, acetylene, and spot welding. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours. ESPENSCHIED.

221. **Farm Power and Machinery Management.** Performance, costs, application, and selection of farm tractors and implements. Selection of machinery systems. Students with credit in Agricultural Mechanization 112 are not given credit for this course. Prerequisite: Agricultural Mechanization 100. 4 hours. BUTLER.

241. **Farm Tractor Power.** Construction and performance of internal combustion engines; power transmission, control, fuel, electrical systems, and hydraulic systems. Analysis of methods and equipment for performance testing. Prerequisite: Agricultural Mechanization 112 or 221. 3 hours. WEBER.

252. **Mechanics of Soil and Water Conservation.** Principles of planning, constructing, and adapting soil conservation and drainage practices for Illinois farms, and the application of surveying to these practices. Lectures, field work, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours. MITCHELL.

272. **Farm Buildings.** Requirements of farm buildings, problem analysis and planning, building plans, materials, construction methods, and costs. Lectures, discussions, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours. CURTIS.

281. **Farmstead Mechanization.** Fundamental electric laws; planning electric wiring systems; single-phase motor selection, care, and application; introductory study of principles and planning required for materials handling systems, drying, water pumps and systems, and lighting and ventilation in agricultural production. Prerequisite: Agricultural Mechanization 100 or 201. 3 hours. HALL.

300. **Special Problems.** An agricultural problem with engineering implications is selected for study, investigation, and report wherein a satisfactory solution does not require a background of engineering education. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. Prerequisite: Not open to students on probation; senior standing; written consent of instructor and authorized departmental approval is required prior to advance enrollment and registration. Specific approval of the associate dean is required in advance of registration for a second special problem course. 1 to 4 hours, or 1/4 to 1 unit.

331. **Farm Machinery Technology.** The role of forces, motions, and strengths in the operation and performance of common farm machinery mechanisms. Study of mechanism illustration, machinery testing, service problems, and other aspects of the equipment distribution industry. Field trip to farm equipment manufacturing and distribution centers; estimated cost, \$15.00. Prerequisite: Agricultural Mechanization 221. 4 hours or 1 unit. HUNT.

361. **Development and Function of Family Housing.** Same as Home Economics 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials and structure, economic influence, costs, and adaptations; personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural engineering students, no prerequisite). 3 hours or 3/4 unit. HANSEN.

381. **Electro-Mechanical Agricultural Systems.** Application of electric power and mechanical equipment to livestock production, crop conditioning, and materials handling systems for efficient use of time, power, and labor. Principles of planning materials handling systems; requirements for environmental control in agricultural production; electric controls circuits; and factors affecting drying, cooling, and processing of crops. Prerequisite: Agricultural Mechanization 281 or graduate standing in agriculture. 3 hours or 3/4 unit. OLVER.

AGRICULTURE

Program Administrator: Associate Dean K. E. GARDNER

Office: 104 Mumford Hall

Note: The courses listed under agriculture are those in the College of Agriculture not assignable to a particular department. They are taught by members of the administrative staff and others.

100. **Agriculture in Modern Society.** Analysis of agriculture in contemporary society and introduction to problems and challenges related to agriculture. Includes a brief orientation to the University and the College of Agriculture. Required of all freshmen in agriculture. 1 hour.
106. **Functional Writing, I.** Instruction and practice in functional writing related to unique interests of students in the College of Agriculture. Designed primarily to be taken with freshman rhetoric by students with special need for improvement in their use of English. Restricted to students in the College of Agriculture. 1 to 2 hours.
107. **Functional Writing, II.** Continuation of Agriculture 106. Prerequisite: Agriculture 106 or consent of instructor. 1 to 2 hours.
114. **Agricultural Journalism.** Same as Journalism 114. Writing farm and home news and information material for use in weekly and daily newspapers; principles of news photography and use of other types of illustrations; how to use related forms of writing, visual aids, radio, and television as effective tools of communication. Prerequisite: Sophomore standing recommended. 3 hours.
190. **Freshman Honors Seminar: International Problems as Related to Agriculture.** Same as Home Economics 190. Lectures and discussion dealing with the broad national and international problems of agriculture. The group explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
192. **Honors Seminar: Science, Food, and World Population.** Same as Home Economics 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival. The group explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
206. **Cooperative Extension Work.** A study of the history, organization, objectives, programs, and methods of extension work. Prerequisite: Agriculture 114; a course in sociology or consent of instructor. 3 hours.
208. **Cooperative Extension Work: Summer Experience.** Full-time work with extension service programs in selected counties under the direction of either farm or home advisers and assistant state leaders. Approximate training period is June to September. Salary sufficient to cover maintenance and expenses provided. Term report required. It is recommended that this course be preceded by Agriculture 206 or Home Economics 377. Prerequisite: Consent of instructor. 2 hours. Offered in the summer session only.
214. **Advanced Agricultural Journalism.** Same as Journalism 214. Techniques and practice in planning and producing farm and home radio and television programs; editing of

popular style leaflets and bulletins based on technical materials; special projects in visual aids, photography, or feature writing; planning informational campaigns using all types of media. Prerequisite: Agriculture 114 or consent of instructor. 3 hours.

- 28. Agriculture Junior-Senior Seminar.** A study of leadership challenges facing agriculture and selected professions within it. Explores background, scope, goals, and methods. Class time one-half college-wide, one-half departmental. Open to students in agricultural economics, agronomy, agricultural communications, horticulture, and other agricultural curricula by permission of instructor. 1 hour.

AGRONOMY

Head of Department: Professor R. W. HOWELL

Department Office: W-201 Turner Hall

- 101. Introductory Soils.** The nature and properties of soils including origin, formation, and biological, chemical, and physical aspects. Prerequisite: Chemistry 101, 111, or former 102; credit or registration in Geology 105. 4 hours.
- 110. Plant and Animal Genetics.** Same as Animal Science, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours.
- 121. Principles of Field Crop Science.** An introductory course. Kinds, origin, taxonomy, morphology, physiological and ecological bases of growth, reproduction, improvement and utilization of corn, soybeans, small grains, forage crops, and sorghums; cropping and tillage practices and principles; field crop production hazards. 4 hours.
- 290. Undergraduate Agronomy Seminar.** The course includes reports and discussions of crops and soils research. Prerequisite: Senior standing. 1 hour.
- 300. Advanced Special Problems.** Individual problems in crops or soils. Graduate students majoring in agronomy do not receive graduate credit. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor. Approval of the Agronomy Teaching Coordinator is required prior to advance enrollment and registration. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or 1/2 to 2 units.
- 301. Soil Survey with Emphasis on Illinois Soils.** Properties and methods used in distinguishing soils; characteristics and distribution of different soils in Illinois; the cause of these differences and their influence upon proper soil use and management. Laboratory work includes instruction in mapping soils and the use of soil maps, and field trips to examine representative soils. Estimated cost of field trips, \$10.00. Prerequisite: Agronomy 101 or consent of instructor. 3 hours or 3/4 unit.
- 303. Soil Fertility and Fertilizers.** Factors affecting the supply of available major, secondary, and minor elements in soils and their influence on crop production; evaluating fertilizer and lime needs; fertilizer manufacture, sources, and application methods. Prerequisite: Agronomy 101. 3 hours or 3/4 unit.
- 304. Soil Management and Conservation.** Application of principles of soil management to the solution of land use and conservation problems. Influence of soil characteristics on drainage, erosion control, cropping intensity, water management, and land use planning. Prerequisite: Agronomy 101. 3 hours or 3/4 unit.
- 305. Biochemical Processes in Soil and Water Environments.** Metabolic processes leading to chemical transformations in soil and water environments; implications for soil fertility and environmental pollution. Prerequisite: Microbiology 100; Chemistry 102. 3 hours or 3/4 unit.
- 306. The Dynamics of Soil Development.** Soils as complex dynamic bodies are related to

various disciplines important to their understanding, such as geology, geomorphology, chemistry, and ecology; the importance of having an overall model to help in understanding soils is discussed; two field trips to be arranged. Prerequisite: Agronomy 101, Chemistry 102, or consent of instructor. 3 hours or 3/4 unit.

307. **Soil Chemistry.** A course emphasizing the inorganic reactions involved in soil development and plant nutrition in soils. Topics discussed include colloid systems, properties of water, ion exchange equilibria, plant nutrient forms, and methods of analyses. Prerequisite: Agronomy 101; Chemistry 102. 3 hours or 3/4 unit.
308. **The Physics of the Plant Environment.** The physics of transport processes in the soil and aerial environment of plants; exchanges of energy and gases in crop canopies and the retention of flow of water, gases, solutes, and heat in soils. Prerequisite: Physics 102; one semester of calculus. 4 hours or 1 unit.
312. **Farm Appraisals.** Same as Agricultural Economics 312. Valuation methods and value bases of farm real estate. Includes legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agronomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, \$7.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, 3/4 or 1 unit).
313. **Soil Mineral Analysis.** Specialized analytical procedures for determinations of soil minerals and their properties; mineralogy of soils and relationships to soil genesis and fertility. Prerequisite: Agronomy 101 or consent of instructor. 4 hours or 1 unit. Offered in 1973-1974 and in alternate years.
319. **Environment and Plant Ecosystems.** Same as Forestry 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes. The physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels are discussed in basic language. Prerequisite: One course in biology; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or 3/4 unit.
320. **Crop Physiology.** The physiological basis of crop plants; how the physiological processes influence potential crop yield and crop production. Prerequisite: Botany 100 or equivalent; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or 3/4 unit.
322. **Forage Crops and Pastures.** Forages, their plant characteristics, ecology and production, grasslands of farm and range as related to animal production and soil conservation. Prerequisite: Agronomy 121. 3 hours or 3/4 unit.
323. **Principles of Plant Breeding.** Same as Horticulture 323. Genetic and cytological variation in crop plants, the production and control of such variation in developing varieties in crop plants, the production and control of such variation in developing varieties and hybrids, and the maintenance of high quality seed stocks. Field trips; estimated cost, \$5.00. Prerequisite: Botany 100; Agronomy 110 or equivalent. 4 hours or 1 unit.
326. **Weeds and Their Control.** Weeds, their introduction, methods of dissemination, reproduction, and control; a characterization of the common weeds of the Midwest. Prerequisite: Agronomy 121. 3 hours or 3/4 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Service, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analysis of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or 3/4 unit.
350. **Crops and Man.** Interpretations of the role of crop plants in the development of cultures and civilizations. Crops are described primarily in terms of their origins, evolution, and influences on man's technology, art, and religion, and his social and political institutions. Field trip; estimated cost, \$10.00. 3 hours or 3/4 unit.
365. **Digital Computer Methods for Statistical Data Processing.** Same as Computer Science

365. A study of methods for efficient utilization of high-speed equipment in the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: Computer Science 101, 103, 107, or 121, and a course in statistics or statistical methods, or equivalent, or consent of instructor. 3 hours or 1 unit.
377. **Diseases of Field Crops.** Same as Plant Pathology 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years.
400. **Seminar.** Discussions of current literature in crops and soils. Required of all graduate majors in agronomy. 0 credit.
402. **The Chemistry of Soil Fertility.** The chemistry of the essential plant nutrients in soils, their reactions and their quantitative relationship to plant growth. Lectures, discussion, and assigned reading. Prerequisite: Agronomy 101; Chemistry 122. 1 unit. Offered in 1972-1973 and in alternate years.
403. **Genesis, Morphology, and Classification of Soils.** Historical review of soil genesis and classification; morphology and genesis of diagnostic soil horizons and features; soil genesis processes and reactions; classification of soils; characteristics, geography, and production potentials of major soil groups of the world. Lectures, discussions, and assigned readings. Prerequisite: Agronomy 301 or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
405. **Colloidal Chemistry of Soils.** Soil components, their nature, and their influence on the physical, chemical, biological, and electrokinetic properties of soils. Lectures, discussions, and assigned reading. Prerequisite: Chemistry 340 and 341, or equivalent. 1 unit.
411. **Soil Physics.** The derivation and application of the fundamental physical principles and laws which govern the behavior of soils. Transport phenomena and physical characteristics of soils are emphasized. Lectures, discussions, and assigned readings. Prerequisite: One year of calculus. 1 unit. Offered in 1972-1973 and in alternate years.
412. **Soil Organic Matter.** Basic considerations in organic matter transformation; geochemistry of organic matter; nature and origin of humic substances; reactions of organic matter in soils and sediments. Lectures, discussions, and assigned readings. Prerequisite: Consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years.
414. **Physical Chemistry of Clays and Soils.** Same as Mining Engineering and Ceramic Engineering 414. The application of physical chemical principles and concepts to surfaces and absorption on surfaces. Silicate surfaces and water absorption are emphasized. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
422. **Pasture, Range, and Soil Conservation Research.** Discussion and study of data and literature pertaining to pastures, range, and soil conservation; application of research methods to the evaluation of forage species in the management and utilization of pasture and range and to soil conservation. Prerequisite: Agronomy 121 or 322. 1 unit.
423. **Cytogenetic and Evolutionary Basis of Plant Breeding.** Nature and origin of crop species; genetic and cytogenic basis for developing special plant materials and the use of such materials in breeding programs. Emphasis on discontinuous variation. Prerequisite: Agronomy 323, or equivalent, or consent of instructor. 1 unit.
424. **Mineral Nutrition of Plants.** Same as Botany and Horticulture 424. A study of the uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in the light of metabolic activity and constituency in functional plant compounds. Major emphasis is placed on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
429. **The Evolution of Agricultural Economies.** Same as Anthropology and Geography 429. The problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and from the point of view of agronomy and plant genetics.

The regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.

436. **Advanced Plant Physiology: Photosynthesis.** Same as Botany 436. A lecture and laboratory course dealing with physiological, biochemical, and biophysical aspects of photosynthesis. Prerequisite: One year each of college biology, chemistry, and physics, or consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Agronomy 340 or equivalent. 3/4 unit.
441. **Advanced Design and Analysis of Biological Experiments.** Same as Agricultural Engineering 441. Design and analysis of complex experiments. Confounded factorials, lattice designs, and other incomplete-block experiments are considered from the viewpoint of their characteristics, methods of analysis and usefulness in biological research. Offered in 1972-1973 and in alternate years. Prerequisite: Agronomy 440 or equivalent. 1/2 unit.
442. **Environmental Plant Physiology.** Same as Botany 442. A lecture course dealing with the interaction of plants and environment at the level of the whole organism, extending to the cell and the community. Heat and mass transfer, plant and soil potentials, and the effects of light on growth are emphasized. Prerequisite: Chemistry 131, general physics, general or plant physiology, and consent of instructor. 1 unit.
444. **Quantitative Aspects of Plant Breeding.** A study of the theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction, and effectiveness of different selection procedures. Prerequisite: Agronomy 323 or equivalent; Agronomy 440 or equivalent. 1 unit.
462. **Origin of Variation in Plants.** Same as Botany 462. A study of the principles of plant evolution. Theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaptation are discussed. Prerequisite: Consent of instructor. 1 unit.
493. **Advanced Studies in Agronomy.** Directed and supervised detailed study of selected problems or topics. Prerequisite: Consent of instructor. Study may be in any one of the following fields:
 - (a) Soil Chemistry.
 - (b) Soil Fertility.
 - (c) Soil Physics.
 - (d) Soil Classification and Pedology.
 - (e) Soil Mineralogy.
 - (f) Soil Microbiology.
 - (g) Plant Breeding and Genetics.
 - (h) Plant Physiology.
 - (i) Weed Control.
 - (j) Crop Morphology.
 - (k) Crop Production and Ecology.
 - (l) Statistical Techniques and Data Processing.
499. **Thesis Research.** 0 to 4 units.
 - (a) **Soils.** ALDRICH, J. ALEXANDER, BEAVERS, BOAST, BRAIDS, FEHRENBACHER, FISHER, GEISEKING, HASSETT, HINESLY, JONES, KOEPPE, KURTZ, MELSTED, R. MILLER, ODELL, OSCHWALD, PECK, PERRIER, PETERS, RAY, RUNGE, RUSSELL, STEVENSON, THORNE, TYNER, WALKER, WELCH.
 - (b) **Crops.** D. ALEXANDER, BERNARD, BOYER, BROWN, BURGER, CARMER, COOPER, DEWET, DUDLEY, EARLEY, GERDEMANN, GRAFFIS, HADLEY, HAGEMAN, HANSON, HARLAN, HARPER, HILTIBRAN, HITTLE, HOOKER, HYMOWITZ, JACKOBS, JUGENHEIMER, KNAKE, LAMBERT, LAUGHNAN, LENG, MCGLAMERY, MCKIBBEN, D. A. MILLER, OGREN, PATTERSON, RINNE, SCOTT, SEIF, SLIFE, STOLLER, WAX, WEBER, WIDHOLM, WILSON, WOOLLEY.

AIR FORCE AEROSPACE STUDIES

Head of Department: Colonel A. T. REID

Department Office: 230 Armory

100. **Corps Training.** A practical training program designed to teach students basic military drill movements, customs, and courtesies of the service, and principles of group leadership. All students in the Air Force R.O.T.C. program are required to participate in this laboratory. The specific training varies in depth with the experience and cadet grade of the individual. One hour of laboratory per week. No credit, but must be taken in conjunction with other courses.
111. **Freshman Theory Course: United States Military Forces in the Contemporary World, I.** An introductory course to familiarize the student with the doctrine, mission, and organization of the United States Air Force. The functions of United States strategic offensive forces and United States strategic defensive forces are covered. Prerequisite: Consent of Professor of Air Force Aerospace Studies. 1 hour.
112. **Freshman Theory Course: United States Military Forces in the Contemporary World, I.** Continuation of Air Force Aerospace Studies 111. Includes a further study of United States strategic defensive forces with the emphasis being placed on missile defense; United States General Purpose Forces and Aerospace Support Forces which includes a discussion of the Army, Navy, Marine Corps, and major commands of the Air Force. Prerequisite: Air Force Aerospace Studies 111 or consent of Professor of Air Force Aerospace Studies. 1 hour.
121. **Sophomore Theory Course: United States Military Forces in the Contemporary World, II.** A study of the organization of the Department of Defense and the role of the military in national policies. In addition, an analysis of the nature and principles of war is presented. Prerequisite: Air Force Aerospace Studies 112 or consent of Professor of Air Force Aerospace Studies. 1 hour.
122. **Sophomore Theory Course: United States Military Forces in the Contemporary World, II.** Continuation of Air Force Aerospace Studies 121. Includes a study of the military policies and strategies of the Soviet Union and China, the role of alliances in United States defense policy, and some of the various elements and processes in the making of defense policy. Prerequisite: Air Force Aerospace Studies 121 or consent of Professor of Air Force Aerospace Studies. 1 hour.
231. **Junior Theory Course: Growth and Development of Aerospace Power, I.** A survey course about the nature of war; development of airpower in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; the future development of aerospace power. Includes problems in space exploration. Prerequisite: Completion of all freshman and sophomore theory courses or consent of the Professor of Air Force Aerospace Studies; successful passing of appropriate mental aptitude and physical test. 3 hours.
232. **Junior Theory Course: Growth and Development of Aerospace Power, II.** A survey course about the nature of war; development of airpower in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; the future development of aerospace power. Includes problems in space exploration. Prerequisite: Completion of all freshman and sophomore theory courses or consent of the Professor of Air Force Aerospace Studies; successful passing of appropriate mental aptitude and physical test; satisfactory completion of Air Force Aerospace Studies 231 or consent of the Professor of Air Force Aerospace Studies. 3 hours.
241. **Senior Theory Course: The Professional Officer, I.** A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the Military Justice System; leadership theory, functions, and practices, management principles and function; problem solving; management tools, practices, and controls. Prerequisite: Completion of all freshman and sophomore theory courses or consent of the Professor of Air Force Aerospace Studies; successful passing of the Air Force Qualification Test and a military physical examination. 3 hours.

242. **Senior Theory Course: The Professional Officer, II.** A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the Military Justice System; leadership theory, functions, and practices; management principles and function; problem solving; management tools, practices, and controls. Prerequisite: Completion of all freshman and sophomore theory courses or consent of the Professor of Air Force Aerospace Studies; successful passing of the Air Force Qualification Test and a military physical examination. 3 hours.

ANIMAL SCIENCE

Head of Department: Professor D. E. BECKER

Department Office: 328 Mumford Hall

100. **Introduction to Animal Science.** A survey of the livestock and poultry industries with emphasis on the importance of product technology and the basic principles of nutrition, genetics, physiology, and ecology as they apply to the breeding, selection, feeding, and management of beef cattle, horses, poultry, sheep, and swine.
104. **Selection and Use of Meats.** A general approach to the subject of meat utilization with emphasis devoted to the physical and chemical composition, nutritive value, selection, and utilization of meat cuts. When appropriate, field trips are taken to area commercial establishments; approximate cost, \$10.00. 2 hours. Offered in 1973-1974 and in alternate years. SCHMIDT.
110. **Plant and Animal Genetics.** Same as Agronomy, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. ALEXANDER and others.
199. **Undergraduate Open Seminar.** 0 to 5 hours.
200. **Special Problems.** Individual research in animal science. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
201. **Livestock Management.** Same as Dairy Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Animal science and dairy science majors do not receive credit for this course. Prerequisite: Animal Science 221 or 325. 5 hours. JOHNSON, SPAHR.
205. **Meat Selection and Classification.** Characteristics associated with the value of carcasses and wholesale cuts from meat animals; grading and classification. Field trips to meat packing plants are required; approximate cost, \$20.00. Prerequisite: Animal Science 209. 2 hours. ROMANS.
206. **Light Horse Management.** The horse industry; anatomy, selection, breed types, gaits, nutrition and feeding, breeding and reproduction, health and disease, tack and equipment, training and showing, and housing of pleasure horses. 3 hours. ALBERT.
209. **Meat Animal Evaluation.** Principles and techniques of meat animal and carcass evaluation and their relationship to current practices in industry. Demonstrations and student participation. Prerequisite: Animal Science 100. 3 or 4 hours. Students may register for 3 hours credit without the laboratory or for 4 hours credit with the laboratory in animal slaughter and carcass fabrication. ROMANS.
211. **Breeding Animal Evaluation.** A study of the origin and improvement of modern breeds of livestock used as foundation stock for commercial production of meat and wool. Emphasis is given to the changing status of modern breeds as influenced by selection,

- economic conditions, and market trends. Prerequisite: Animal Science 209. 3 hours. ALBERT.
212. **Advanced Livestock Evaluation.** Advanced instruction in evaluating meat animals for slaughter and selection of breeding animals. Laboratory. Prerequisite: Animal Science 209. 3 hours. ALBERT.
221. **Animal Nutrition.** Same as Dairy Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Animal Science 221 and 325. Prerequisite: Chemistry 102. 4 hours. BAKER, BAUMAN, HATFIELD.
230. **Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Dairy Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104 and one course in chemistry. 3 hours. DZIUK, HAYS.
299. **Seminar.** Individual oral presentations and written reports by senior students in animal science on subjects related to research in the animal sciences. Prerequisite: Senior standing. 1 hour. GARRIGUS.
301. **Beef Production.** The principles of feeding and management of beef cattle; financial aspects of beef production; diseases, parasites, and breeding difficulties of beef cattle. Lectures, demonstrations, and discussions. Prerequisite: Animal Science 221 or equivalent. 3 hours or 3/4 unit (summer session, 1/2 or 3/4 unit). NEUMANN.
302. **Sheep Production.** The sheep and wool industries; principles and practices of various phases of production. Students may register for three hours credit without laboratory, for four hours credit with laboratory, or for three-fourths unit. Prerequisite: Animal Science 221 or equivalent. 3 or 4 hours, or 3/4 unit. GARRIGUS.
303. **Pork Production.** The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. Prerequisite: Animal Science 221 or equivalent. 3 hours or 3/4 unit. HARMON, JENSEN.
304. **Poultry Management.** The application of science and technology in solving the breeding, feeding, housing, and various management problems encountered in commercial egg and poultry meat production. Prerequisite: Animal Science 221 or 325, or equivalent. Three hours credit without or four hours credit with individual study and conference, or three-fourths unit. 3 or 4 hours, or 3/4 unit. BRAY.
305. **Genetics and Animal Improvement.** Same as Dairy Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Animal Science 110 or equivalent. 3 hours or 3/4 unit (summer session, 1/2 unit). LEE, RASMUSEN.
309. **Meat Science.** Fundamental biological principles that influence growth, composition, processing, preservation, and quality of meat and meat products. Prerequisite: Chemistry 102; Microbiology 100 and 101 or 200 and 201. 4 hours or 1 unit. SCHMIDT.
320. **Nutrition and Digestive Physiology of Ruminants.** Same as Dairy Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Animal Science 221. 3 hours or 3/4 unit. DAVIS, HINDS.
325. **Principles of Animal Nutrition.** Principles of animal nutrition and their application to veterinary practice. This course is designed primarily for students in veterinary medicine. Credit is not given for both Animal Science 325 and 221. Prerequisite: Chemistry 354 or Chemistry 350 and 355. 5 hours or 1 1/4 units. OWENS.
330. **Reproduction and Artificial Insemination of Farm Animals.** Same as Dairy Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science or Animal Science 100. 3 hours or 3/4 unit (four-week summer session, 1/2 unit). GRAVES, LODGE.
332. **Livestock Marketing.** Same as Agricultural Economics 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; evaluation of changes in the industry affecting marketing decisions.

Field trip; estimated cost, \$15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or 3/4 or 1 unit. BROADBENT.

340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, and 112, or equivalent. 4 hours or 3/4 unit. SEIF.
341. **Human Evolution, II.** Same as Anthropology 341. The principles of human genetics, anthropological aspects of race and race formation, and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 102 or Zoology 101 or 104, or consent of instructor. 3 hours, or 1/2 or 1 unit. Additional work is required of graduate students registering for 1 unit of credit in this course.
346. **Ethology.** Same as Anthropology and Zoology 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or 3/4 unit.
347. **Ethology Laboratory.** Same as Anthropology and Zoology 347. Laboratory in ethology. Prerequisite: Animal Science 346; consent of instructor. 3 hours or 3/4 unit.
350. **World Animal Agriculture.** Same as Dairy Science 350. Survey and interpretation of the role of animal agriculture in various cultures of the world with particular references to underdeveloped countries of the world. The importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people is discussed. Prerequisite: Consent of instructor. 3 hours or 3/4 unit. KASTELIC.
400. **Presentation of Experimental Results.** Preparation of technical material for oral or written presentation. 1/4 unit. DZIUK.
401. **Animal Bionomics.** A lecture and discussion course pertaining to the ecological factors affecting physiological, functional, behavioral, and productive response of domestic animals. Prerequisite: Consent of instructor. 1/2 unit. CURTIS.
402. **Principles of Sheep and Wool Production.** Basic considerations in sheep and wool production and lamb feeding. Reports of research. Prerequisite: Consent of instructor. 1/2 unit. HATFIELD, JOHNSON, OWENS.
403. **Techniques and Topics in Animal Research.** Discussion and study of literature pertaining to animal research; application of experimental techniques; special topics; review of research; application of experimental techniques; special topics; review of research in current problem areas. Prerequisite: Consent of instructor. 1/2 unit. HARMON, HINDS.
404. **Concepts in Nonruminant Nutrition.** A review of current literature in nonruminant nutrition. Prerequisite: Consent of instructor. 1/2 unit. BAKER.
406. **Physiology of Reproduction.** Same as Zoology 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit. DZUIK, NALBANDOV.
408. **Laboratory Methods in Physiology of Reproduction.** Same as Zoology 408. Prerequisite: Consent of instructor. 1/2 to 1 unit. Combined credit in Animal Science 407 and 408 may not exceed 2 units. NALBANDOV.
409. **Muscle Biology.** Microstructure and chemical composition of muscle tissue. Chemistry and biosynthesis of muscle and connective tissue proteins. Biochemical aspects of muscle contraction and rigor mortis. Prerequisite: Biochemistry 350 and 355. 1/2 unit. ROBSON.
410. **Research Methods in Animal Science.** Intended to give students training and experience in various techniques used in research with poultry, sheep, swine, beef cattle, and meats. Prerequisite: Consent of instructor. 1/4 to 1 unit; may be repeated for credit not to exceed a total of 1 unit.
412. **Advanced Endocrinology.** Same as Dairy Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Consent of instructor. 1/2 unit; may be repeated for credit not to exceed a total of 2 units. GORSKI, NALBANDOV.

415. **Advanced Animal Genetics.** Same as Dairy Science 415. Genetic theory, analysis of animal breeding problems, genetic results of selection, and different systems of breeding. Prerequisite: Animal Science 305 or equivalent. 1 unit. NORTON.
416. **Population Genetics and Animal Breeding.** Same as Dairy Science 416. The mathematical theory of population genetics and its application to the improvement of farm animals; results of different systems of mating and the expected gains from different methods of selection. Prerequisite: Animal Science 110 or equivalent. A knowledge of elementary algebra is essential. 1 unit.
420. **Comparative Nutrition.** Physiological aspects of the nutrition of higher animals and man, including the digestion, utilization, and function of nutrients, and the effects of dietary deficiencies. Prerequisite: Chemistry 350 and 355. 1 unit. BAKER, FORBES.
421. **Topics in Nutritional Biochemistry.** Biochemical aspects of the nutrition of higher animals and man, with emphasis on the function and metabolism of nutrients. Prerequisite: Animal Science 420. 1 unit. MISTRY, OWENS.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Animal Science 340 or equivalent. 3/4 unit. SEIF.
463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Veterinary Medical Science 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, biology, and/or consent of instructor. 3/4 unit. TWARDOCK.
481. **Animal Biochemical Laboratory Techniques.** Same as Dairy Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences. Isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; determination of metabolic pathways and processes. Prerequisite: Chemistry 350 and 355; consent of instructor. 1 unit. LARSON.
499. **Thesis Research.** 0 to 4 units.

ANTHROPOLOGY

Head of Department: Professor D. W. PLATH

Department Office: 109 Davenport Hall

REQUIREMENTS FOR I.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty-eight hours in anthropology, including either Anthropology 101 or the Anthropology 102-103 sequence, but not both. Students are strongly advised to take at least one course in each of the principal sub-fields of general anthropology: social anthropology, applied anthropology, archaeology, biological anthropology, and linguistic anthropology. In view of entrance requirements for graduate study, students who contemplate seeking an advanced degree in anthropology should take Anthropology 200, 220, 230, and 240.

Minor: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: art, biochemistry, biology, communications, computer science, classics, economics, geography, geology, history, linguistics, mathematics, music, philosophy, physiology, political science, psychology, sociology, or zoology. Students may also elect to minor in certain interdisciplinary topics, interdepartmental programs, or languages. In circumstances where a student's plans make other fields of study particularly appropriate, he may petition the Head of the Department of Anthropology for approval of a special minor.

Departmental Distinction: For graduation with Departmental Distinction, thirty-two hours in anthropology with a grade-point average of 4.4 or better including at least four hours credit for Anthropology 290 or 291. For graduation with High or Highest Distinction, the same minimum requirements, plus a senior honors thesis (written for Anthropology 291) or an equivalent project to be submitted to the Department of Anthropology by the first day of the month preceding the month of graduation. A departmental honors board will assign Distinction, High Distinction, or Highest Distinction based on grade-point average, quality of the honors thesis or project, and (at its option) performance on written or oral comprehensive examinations. Students apply for degrees with Distinction by registering in Anthropology 290 or 291; they apply for degrees with High or Highest Distinction by submitting the senior honors thesis or equivalent project. Those students who do not qualify academically, but who feel they are worthy of Departmental Distinction for other reasons, may, with the approval of a faculty sponsor, petition the head of the department for permission to submit a special thesis meeting College of Liberal Arts and Sciences and departmental requirements for distinction.

101. **Concepts in General Anthropology.** Offered as a concentrated alternative to the Anthropology 102 and 103 sequence, this course introduces fundamental concepts in human biology, prehistory, culture and society, and linguistics. It is taught by a faculty team representing the subfields of general anthropology, who present their subjects by examining important issues and problems in the discipline. An understanding of these crucial ideas and their interrelationships prepares serious students to go directly into more advanced courses. Credit is not given for Anthropology 101, and Anthropology 102 and 103. 4 hours.
102. **Introduction to Anthropology: The Origin of Man and Culture.** An introduction to and survey of human origins and early man, physical anthropology, race and racism, archaeology, and the beginning of human civilization. Recommended though not required to be taken with Anthropology 103 as a survey of the field of anthropology. Credit is not given for Anthropology 102 and 103, and Anthropology 101. 4 hours.
103. **Introduction to Cultural Anthropology.** This course is a survey of cultural anthropology. It deals with the nature of culture and its various aspects including social organization, technology, economics, religion, and language, as these are seen among contemporary primitive or preliterate peoples. Some attention is also given to distinctive theoretical approaches and to problems of culture change. Credit is not given for Anthropology 103 and 102, and Anthropology 101. 4 hours.
143. **Biological Bases of Human Behavior.** Same as Psychology and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication, social organization, parental, sexual, and aggressive behavior. 3 hours.
168. **Indian Civilization and Society.** Same as History 168. An introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as History 169. An interdisciplinary introduction to modern South Asian history and society. 4 hours.
173. **Cultural Diversity.** Cultural diversity poses personal problems as well as social issues. Surveys various cultures as collective patterns for living and as attempts to create a more human way of life. It examines methods for depicting and interpreting cultural codes of behavior, thought, and feeling, with stress on the uses of ethnography in a world of plural cultures. 3 hours.
174. **American Communities and Their Problems.** Formerly Liberal Arts and Sciences 174. An examination of American society and its cultural heterogeneity through the study of selected communities, community problems, and solution alternatives. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elements of Linguistics.** Same as Linguistics 200. An elementary survey of the methods used in descriptive and historical linguistic analysis, with application to languages

usually taught in college. Prerequisite: One year of a foreign language or equivalent. 3 hours.

210. **Family Relationships.** Same as Home Economics 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; examination of selected family adjustment problems. 3 hours.
220. **Introduction to Prehistory.** An introduction to the problems of studying past cultures. Special attention is given to the ranges of techniques available and the adequacy of various methodologies as bases for sound inference about the structure of extinct cultures. Prerequisite: Anthropology 102 or consent of instructor. 3 hours.
222. **Introduction to Modern Africa.** Same as African Studies and Political Science 222. An interdisciplinary introduction to modern Africa dealing with basic themes and problems in the geography, politics, economics, sociology, anthropology, and history of Africa. 3 hours.
230. **Introduction to Social Anthropology and Ethnology.** An introduction to the anthropological study of contemporary human societies. Emphasis is on the comparative study of social organization, interpersonal relations, cultural ecology, and processes of socio-cultural change, but includes some consideration of the method and theory of ethnological field research. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours.
240. **Introduction to Biological Anthropology.** The past and present evolution of man and his populational and individual biological variation. Topics include genetic principles relevant to human evolution, primate phylogeny and behavior, fossil evidence for human evolution, and the origin and significance of biological diversity in modern man. Prerequisite: Anthropology 101, 102, or 143, or an introductory life sciences course, or consent of instructor. 3 hours.
246. **Vertebrate Social Organization.** Same as Psychology, Sociology, and Zoology 246. An introduction to the biosociology of the vertebrates. Emphasis is on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
250. **Introduction to Primitive Technology.** Introduction to the technology of nonindustrial societies, relationships of technology to society, and influence of social and cultural factors on technological innovation. Ethnographic, historical, and archaeological data are used. 3 hours.
260. **Peoples of the World: Introduction to Ethnography.** The study and criticism of ethnographic descriptions of exotic ways of life, both as scientific reporting and as a literary art form. Readings include examples from several major culture areas: Africa, the Americas, the Middle East, Oceania, Southern and Eastern Asia, and Western civilization. Prerequisite: Anthropology 101, 102, or 103, or consent of instructor. 3 hours.
261. **Afro-American Societies and Cultures.** Designed to examine the breadth of the black Americas in South America, Central America, the Caribbean (including Spanish, Gallic, Dutch, and English subareas), and Canada, with specific comparisons to rural and urban United States. The African slave trade with reference to black-white relations in the trade; the development of Creole cultures in West Africa and in Spain and subsequent cultural elaboration in the New World. Conditions of slavery, slave revolts, migrations of black people in the New World. Examination of selected ethnographic material. Prerequisite: Anthropology 101, 102, or 103, or consent of instructor. 4 hours.
280. **Anthropological Theory in Contemporary Perspective.** Designed primarily to explore the current state of theory and conceptualization in cultural and social anthropology. Emphasis is placed on the relationship between current theoretical and conceptual formulations and the historical development of anthropological thought. Prerequisite: A major in anthropology or consent of instructor. 3 hours.
289. **Independent Study Course.** Supervised reading and research on anthropological topics chosen by the student with staff approval. Especially (but not exclusively) for students who are preparing for a summer field work project; or who have some justifiable reason

for doing independent study, but who do not qualify for the honors (departmental distinction) courses. This course may not be taken concurrently with Anthropology 290 or 291. Prerequisite: Junior or senior standing; twelve hours in anthropology; consent of instructor. 2 to 4 hours.

290. **Honors Course.** Individual study and research projects for those students who are candidates for Departmental Distinction in anthropology. This course may not be taken concurrently with Anthropology 289. Prerequisite: Senior standing; 4.2 average in anthropology; consent of instructor. 2 to 4 hours.
291. **Honors Thesis.** Preparation and completion of a senior honors thesis, research paper, or equivalent project for those students who are candidates for high or highest Departmental Distinction in anthropology. This course may not be taken concurrently with Anthropology 289. Prerequisite: Senior standing; 4.2 average; consent of instructor. 2 to 4 hours.
300. **Introduction to Linguistics.** Same as Linguistics 300. An introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or 1/2 unit.
307. **Introduction to Mathematical Linguistics.** Same as Linguistics 307. Principles of set theory, logic and formal systems, group theory, and automata theory. Introduction to the formal theory of grammars. Prerequisite: Anthropology 300. 3 hours or 1 unit.
315. **Area Studies in Ethnomusicology.** Same as Music 317. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or 1/2 unit. Maximum accumulated credit, 12 hours or 2 units.
316. **Introduction to Music of the World's Cultures.** Same as Music 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to the methods of collecting and studying music in non-literate, folk, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours or 1/2 unit.
317. **Languages of the World.** Same as Linguistics 317. A survey of the main language families of the world from both genetic and typological points of view, with special reference to the theory of syntactic descriptions. Prerequisite: Anthropology 300 or consent of instructor. 3 hours, or 1/2 or 1 unit.
320. **Political Anthropology.** The analysis of political behavior and the comparison of political systems from an anthropological perspective. Local level political processes and the evolution of governmental forms are emphasized. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
321. **Social Organization and Structure.** An introduction to anthropological concepts of social organization and structure. Considers kinship theory, descent and alliance systems, social stratification, non-kin association, social networks, group identification and boundaries, structural-functional interpretations of society, and the meaning of social or cultural structure. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
322. **Anthropology of Law.** Analyzes the legal systems of several primitive societies, the social context in which such legal systems operate, and the place of such studies in developing a theory of jurisprudence. Special attention is given to legal changes in the developing nations and to the legal problems of minority populations. Prerequisite: Anthropology 103, 260, or 280, or equivalent. 3 hours, or 1/2 or 1 unit.
329. **The Philosophy of Social Science.** Same as Philosophy 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
330. **Processes of Culture Change.** The impact of modern cultures on native peoples, comparative study of the mechanisms underlying the transition to modernity in the new nations, and the psychological and structural aspects of acculturation and urbanization. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or 1/2 or 1 unit.

331. **Aboriginal North America.** The course deals with three major topics: the nature and structure of aboriginal North America as a cultural province and its ecological base; distinctive and common features of American Indian cultures; and responses to the stresses of white contact. Selected type cultures and their adaptations to varying ecological situations are examined in detail. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or 1/2 or 1 unit.
332. **Indians of Lowland South America.** A survey of aboriginal non-Andean peoples in contemporary settings. Historical and geographical bases for cultural adaptation and elaboration. Ethnicity, cultural ecology, social organization, ritual and change in selected areas of Lowland South America. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
333. **South American Indians of the Andean Region.** A survey of Andean cultures at the time of the Spanish conquest, of their subsequent history, and of modern Indian culture in the Andean countries. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
334. **The Structural Study of South American Indian Cultures.** A comparative discussion of cultural systems, including their social, religious, and economic aspects. In general, the better described peoples of South America are considered. Prerequisite: Anthropology 332 or 333, or consent of instructor. 3 hours or 1 unit.
336. **An Introduction to Behavior Genetics.** Same as Psychology 346. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; survey of research and possible extensions of research on behavior-genetic correlates. Students may take Anthropology 337 with this course. Prerequisite: Psychology 100, 103, or 105, or Anthropology 240, or a course in biology; a course in statistics. 3 hours, or 1/2 or 1 unit.
337. **Behavior Genetics Laboratory.** Same as Psychology 347. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Consent of instructor or academic counselor of the Department of Psychology; Anthropology 336 must be taken with this course. 2 hours or 1/2 unit.
340. **Human Evolution, I.** Principles of evolution and a survey of the evolution of man and his progenitors from the early primates through the Pleistocene. Emphasis is on evolutionary theory as applied to man and interpretation of the fossil record. Prerequisite: Anthropology 240, or an introductory zoology course, or consent of instructor. 3 hours or 1 unit.
341. **Human Evolution, II.** Same as Animal Science 341. The principles of human genetics, anthropological aspects of race and race formation, and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 240, or an introductory zoology course, or consent of instructor. 3 hours, or 1/2 or 1 unit. Additional work is required of graduate students registering for 1 unit of credit in this course.
342. **Behavior-Genetic Analysis.** Same as Zoology 350. Concepts, methods, and problems in the analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240, Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or 3/4 or 1 unit.
343. **Introduction to Primate Morphology and Behavior.** Same as Zoology 344. A survey of primate social behavior and the classification, morphology, and distribution of living and extinct species. Emphasis is placed on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240 or 246, or consent of instructor. 3 hours, or 1/2 or 1 unit.
344. **Field and Laboratory Techniques in Biological Anthropology.** Supervised participation in biological anthropology research projects; techniques, methods, and procedures discussed and practiced under actual field or laboratory working conditions. Normally taken concurrently with Anthropology 345. Prerequisite: Anthropology 240 or equivalent; consent of instructor. 3 hours or 1 unit. Students may receive credit more than once if the area or problems involved are different. Usually offered in the summer session only.

345. **Analysis of Research Data in Biological Anthropology.** Analysis, interpretation, evaluation, and organization of field and laboratory data in biological anthropology; preparation of written reports on research. May be taken concurrently with Anthropology 344 or subsequently. Prerequisite: Anthropology 240 or equivalent; consent of instructor. 3 hours or 1 unit. Students may receive credit more than once if the area or problems involved are different.
346. **Ethology.** Same as Animal Science and Zoology 346. Introduction to descriptive and experimental analysis of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or 3/4 unit.
347. **Ethology Laboratory.** Same as Animal Science and Zoology 347. Laboratory in ethology. Prerequisite: Anthropology 346; consent of instructor. 3 hours or 3/4 unit.
348. **The Prehistory of Africa.** The study of cultural development in Africa from the appearance of hominids to the time of European domination. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
349. **South American Culture History, I.** An examination of the factors influencing the initial peopling of South America, the spread and diversification of hunting and gathering economies, and the development and spread of the "tropical forest" cultural pattern. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
350. **South American Culture History, II.** An examination of the factors leading to the rise of civilization in the Central Andes, including the evolution of agricultural systems, the elaboration of technology, and the emergence of extensive and complex political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
351. **Archaeological Surveying: Techniques and Applications.** Familiarization with methods used in the location and recording of archaeological sites, including techniques of mapping especially adapted to the needs of archaeology. Attention also is given to means of presenting results and interpreting data derived from this work. The course involves work both in the field and in the laboratory. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
352. **Mesoamerican Culture History.** A detailed study of the major civilizations of Mexico and Guatemala, with brief reference to other Mesoamerican cultural traditions. Emphasis is on the growth and ramifications of civilizations and the kinds of evidence used to study the growth and interaction of political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
353. **Southwestern Archaeology.** This course is a detailed study of one archaeological unit in the United States, covering the three broad cultures with regional variations considered chronologically and stressing interrelationships of the various cultures. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or 1/2 or 1 unit.
354. **Field Techniques in Archaeology.** Participation in archaeological excavations; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 355. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 101 or 102, or consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
355. **Laboratory Techniques in Archaeology.** Laboratory work including processing, classifying, dating, interpretation, evaluation, and preparation of written reports of archaeological research. May be taken concurrently with Anthropology 354 or subsequently. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 101 or 102, or consent of instructor, 3 hours or 1 unit.
356. **Physical Anthropology.** The aims and methods of physical anthropology, both osteology and somatology, with emphasis on the human skeleton. Prerequisite: Anthropology 240, or a physiology or zoology course in anatomy, or consent of instructor. 3 hours or 1 unit.
357. **Midwestern Prehistory.** A detailed study of the midwestern archaeological area covering the broad cultures with regional variations considered chronologically and stressing their interrelationships. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or 1/2 or 1 unit.

358. **Prehistory of the Old World: Paleolithic and Mesolithic.** Considers the origins of human culture and surveys the development of and relationships among cultural traditions in Africa, Asia, and Europe during the Pleistocene epoch. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
359. **Prehistory of the Old World: Neolithic, Bronze, and Iron Ages.** Continuation of Anthropology 358 into post-Pleistocene times. An introduction to postglacial hunting communities, the origins of food production and animal husbandry, early metallurgy and urbanism, and the rise of major civilizations. Emphasis is on Europe, the Near East, and the Mediterranean basin, with comparisons to Africa and Asia. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
360. **Peoples of Oceania.** A survey of the peoples inhabiting the islands of the Pacific, and their culture history, including Australia, Melanesia, Micronesia, New Zealand, and Polynesia. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
361. **Peoples and Cultures of Mexico and Guatemala.** A survey of the peoples and cultures of middle America with special emphasis upon Mexico and Guatemala. The course begins by placing middle America geographically, historically, and culturally within the broader Latin-American scene. The countries are first viewed as a whole and then selected ethnographic studies of specific communities are considered for comparative purposes. The Caribbean is not studied in this course. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or 1/2 or 1 unit.
363. **Religion in Anthropological Perspective.** An introduction to the study of magical and religious beliefs and practices in tribal and peasant societies. Considers theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socio-religious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
364. **Field Work in Cultural Anthropology.** Supervised participation in field research in ethnography, ethnology, linguistics, or social anthropology; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 365. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
365. **Analysis of Field Data in Cultural Anthropology.** Analysis, interpretation, evaluation and organization of field data in cultural anthropology; preparation of written reports on research in ethnography, ethnology, linguistics, or social anthropology. May be taken concurrently with Anthropology 364 or subsequently. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit.
367. **Cultures of Africa.** Culture and social organization in traditional African societies with emphasis on the politics, kinship, and religion of a small sample of societies illustrating the main cultural variations found in Sub-Saharan Africa. Some discussion of ecological factors and ethnic group relations in pre-colonial times. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
368. **Peoples and Cultures of India.** A description and analysis of the social, economic, and religious life of the tribal and peasant peoples of contemporary India, considered against the background of Indian geography, population, language distribution, the caste system, and highlights of Indian cultural development. Prerequisite: Anthropology 168 and 230, or consent of instructor. 3 hours or 1/2 or 1 unit.
369. **Introduction to Human Ecology.** Same as Geography, Health Education, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 to 5 hours, or 1/2 or 1 unit.

A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.

370. **Language, Culture, and Society.** Same as Communications and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, one course in communications or linguistics, or consent of instructor. 3 hours, or 1/2 or 1 unit.
371. **Culture and Personality.** A cross-cultural comparative analysis and evaluation of current theories of culture and personality formation. The course is concerned with the sociocultural matrix in which personality develops, as well as with the application of personality concepts, especially those derived from psychoanalytic theory, to the study of primitive and modern society. Prerequisite: An introductory course in anthropology, sociology, or psychology, or consent of instructor. 3 hours, or 1/2 or 1 unit.
372. **The Anthropological Study of Art.** A review of the anthropological approach to art with emphasis on structural analysis and the relationship of the artist to his culture. Problems of stylistic development are considered within the framework of cultural dynamics, and a survey of the major art styles, outside the Western tradition and the Orient, is included. Prerequisite: Three hours of anthropology or consent of instructor. 3 hours, or 1/2 or 1 unit.
373. **Theory and Method in the Cross-Cultural Study of Individual Behavior.** Same as Psychology 373. Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception. Methodological limitations and contributions of cross-cultural study are emphasized. Current problems and research are discussed. Prerequisite: Six hours of psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Geography, Health Education, Physiology, Psychology, Sociology, Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology 369. 4 hours or 1 unit.
377. **Social Change in Africa.** Considers problems of social change in Africa from the beginning of the Colonial period. Topics to be considered include colonialism in Africa, nationalism, urbanization and labor migration, changing patterns of leadership, and changes in family structure. Prerequisite: Anthropology 367 or consent of instructor. 3 hours or 1 unit.
378. **Socio-Cultural Factors in African Economic Development.** Same as Rural Sociology 378. An examination of the African "development environment" and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
379. **Medical Anthropology: The Culture of Health and Illness.** An introduction to concepts and social aspects of health, illness, and curing in different cultures; with consideration also of the interaction between folk and modern medicine in developing nations and the delivery of health care as an international social problem. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
380. **Applied Anthropology:** Surveys the role of anthropology in practical affairs and the contributions anthropologists can make in such fields as community development, education, foreign affairs, government, public health, and planning for social or technological change. Prerequisite: Anthropology 230, 260, or 280, or consent of instructor. 3 hours or 1 unit.
381. **Russian Culture History and Ethnology.** Same as Geography 381. A historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or 1/2 or 1 unit.

- 382. Siberian Culture History and Ethnology.** Same as Geography 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or 1/2 or 1 unit.
- 383. Japanese Culture.** Human lifeways in Japanese settings. The course centers on problems of adapting traditional institutions and behavior patterns to the needs of modern industrial civilization. Prerequisite: Anthropology 230, or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
- 384. Traditional Chinese Social Organization.** A descriptive analysis of pre-modern Chinese culture and society with emphasis on domestic organization, rural and urban social structure, local government, and folk religion. Field studies in modern Taiwan and Hong Kong, of the overseas Chinese, and on the mainland are used to exemplify particular aspects of Chinese life. Prerequisite: Anthropology 230, or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
- 385. Anthropology of Education.** Introduction to the contribution of anthropology to the cross-cultural study of education. Includes discussion of material from representative cultures ranging from primitive social groups to present-day national states; education of minority ethnic and subordinate cultures receives special attention. Emphasis is placed on both informal and formal education as a cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 to 4 hours, or 1/2 or 1 unit.
- 386. Peoples and Cultures of Mainland Southeast Asia.** The culture, cultural history, and social systems of mainland Southeast Asia: Burma, Thailand, Cambodia, Vietnam, Laos, Assam Hills, Upland Southwestern China, and Malaya. Emphasizes the interaction of complementary ethnic types in the context of local ecology and the Hindu-Buddhist systems of religion and politics of the lowland states. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
- 387. Peoples and Cultures of Insular Southeast Asia.** A survey of the cultures and social systems of Indonesia, Malaysia, and the Philippines in the context of the region's history and geographical, economic, political, and religious situation. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
- 393. Laboratory in Primate Social Behavior.** Same as Psychology and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior. Instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or 3/4 or 1 unit.
- 429. The Evolution of Agricultural Economies.** Same as Agronomy and Geography 429. The problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and from the point of view of agronomy and plant genetics. The regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
- 440. Problems in Physical Anthropology.** A seminar designed to involve students in the theoretical and methodological approaches to problem areas in physical anthropology. 1 unit. May be repeated for additional credit. Prerequisite: Anthropology 340, 341, or 343; consent of instructor. 1 unit.
- 443. Problems in Primate Behavior and Ecology.** Same as Zoology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects. Topics vary each semester. Prerequisite: Consent of instructor. 1 unit. May be repeated for additional credit.
- 450. Seminar in Anthropology.** Analysis of selected topics of special interest in anthropology. 1 unit. Students may register in this course up to a total of 2 units.
- 451. Social Structure.** This course is intended to acquaint the student with the descriptive techniques and methods of structural and functional analysis currently employed by social anthropologists in the study of primitive social groups and their methods of operation. Prerequisite: Consent of instructor. 1 unit.

452. **Research Problems in Archaeology.** Seminar oriented to current research problems in archaeology, designed to acquaint students with theoretical and methodological aspects of particular problems, and to develop a critical perspective of archaeological research. Course may be repeated for additional credit. Prerequisite: Consent of instructor. 1 unit.
453. **The Formal Analysis of Kinship Systems.** A survey of a variety of the world's systems of kinship, marriage, and family organization. Concentration on the distinctive properties of kinship systems as a species of social structure, on the formal apparatus for describing and understanding them and their functions, and on the theory of kinship that arises from the use of such formal apparatus. Prerequisite: Consent of instructor. 1/2 to 1 unit.
460. **Theories and Methods in Anthropology.** A seminar course identifying, investigating, and evaluating the various theories and trends, as well as methods employed by anthropologists. 1 unit.
463. **Seminar on Field Methods and Research Designs in Cultural Anthropology.** Critical examination of field methods and research designs as reflected in selected studies covering the past seventy years, ranging from early missionary reports to those of contemporary field workers. An effort is made to discern major trends in methodology. Community studies and comparative studies on both the tribal and peasant levels are examined. Prerequisite: Consent of instructor. 1 unit.
489. **Readings in Anthropology.** Individual guidance in intensive readings in the literature of one or more subdivisions of the field of anthropology, selected in consultation with the adviser in accordance with the needs and interest of the student. Prerequisite: One semester of graduate work in anthropology; consent of adviser. 1/2 or 1 unit.
490. **Individual Topics in Anthropology.** Supervised individual investigation or study of a topic not covered by regular courses. The topic selected by the student and the proposed plan of study are approved by the adviser and the staff member who supervises the work. Prerequisite: Consent of instructor. 1 to 4 units.
499. **Thesis Research.** Preparation of theses. 0 to 4 units.

Arabic

(See Linguistics)

ARCHITECTURE

Head of Department: Professor J. H. SWING

Department Office: 104 Architecture Building

100. **Architecture Lectures.** A series of lectures designed to present the relation of architecture to other disciplines and professions, the role of the architect in society, the challenges and opportunities of the profession, and the structure of architectural education programs. Supplementing discussions. Required readings. 1 hour.
101. **Introduction to Environmental Design.** An introduction to the range of involvements and responsibilities in the environmental design professions (historically and emergent); provides conceptual framework for relating other disciplines to design; provides initial experience in problem-solving and communication skills. 3 hours.
171. **Basic Design Studio, I.** An introduction to fundamentals of architectural design: object, perception, and light. Vocabulary: figure-ground composition, balance and movement, proportion and rhythm, mass-space organization, multiple viewing positions, one- and two-point perspective, orthographic projection and freehand drawing. Prerequisite: Credit or registration in Architecture 100 or consent of department. 3 hours.
172. **Basic Design Studio, II.** Continuation of Architecture 171. Prerequisite: Architecture 171. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

- 200. Senior Honors in Architecture.** For candidates for honors in architecture. Independent guided study and research in a selected area of architecture. Prerequisite: Senior standing in architecture, a University grade-point average of 4.0 or, in special cases, approval of the head of the department. 3 hours. May be repeated to a total of 6 hours with approval of head of department.
- 211. Introduction to Ancient and Medieval Architecture.** Historical analysis of architecture in the Near Orient and Europe prior to the Renaissance in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
- 212. Introduction to Renaissance and Modern Architecture.** Historical analysis of Western Architecture from the beginning of the Renaissance to the present in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
- 220. Introduction to Architectural Theory.** Overview of the purpose and means of architecture in relation to other human endeavors and the goals of society; professional alternatives; introduction to research, cognitive processes in design, information handling, communication, and evaluation. Prerequisite: Consent of instructor. 3 hours.
- 231. Architectural Construction, I.** An introduction to the building industry, contract construction, architect's role, contract documents, working drawings and specifications, and building codes and zoning ordinances. Criteria for the selection of materials, products, and systems for buildings; the study of building materials and products. 4 hours.
- 232. Architectural Construction, II.** A study of the building process; the design professions, the builder, the manufacturer. Written and graphic communication. Analysis of building systems; wood, masonry, metal, concrete, plastics. Comparative and aesthetic requirements. Prerequisite: Architecture 231. 3 hours.
- 236. Architectural Design, VII.** Application of the creative design process to solutions for selected architectural projects emphasizing high rise structures, and team solutions to architectural projects. Consideration of external space, internal space, form, function, structure, mechanical and ancillary equipment, use of materials, and construction detail. Prerequisite: Architecture 235. 5 hours.
- 241. Environmental Technology, I.** The integration of environmental control systems in architecture. Factors affecting comfort, health, and safety. The fundamentals of atmospheric conditioning of buildings and the equipment and control systems for varying functions and sizes of buildings. Water supply, waste, sewage, and storm water disposal systems for buildings. Prerequisite: Architecture 232 or consent of instructor. 4 hours.
- 242. Environmental Technology, II.** Nature of light, illumination and vision, quality and quantity, sources; integration of illumination and architecture; power distribution systems equipment. Nature of sound and architectural acoustics. Room acoustics: noise reduction, acoustic correction, sound amplification. Sound isolation: air borne and structure borne sound. Prerequisite: Architecture 232 or consent of instructor. 4 hours.
- 247. Structural Planning.** Comparative structural design of building frames. Relevant factors which influence choice of framing materials or methods including comparative cost analysis, subsoil investigations, and advantages and limitations of structural materials. Prerequisite: Architecture 257. 3 hours.
- 251. Statics and Dynamics.** Introduction to basic statics and dynamics with emphasis on architectural applications. Prerequisite: Mathematics 130 and 135; Liberal Arts and Sciences 141 and 142. 4 hours.
- 252. Strength of Materials and Design Applications.** Introduction to strength of materials with emphasis on architectural applications. Prerequisite: Architecture 251. 4 hours.
- 256. Building Sanitation and Architectural Acoustics.** Water supply and treatment; sewage disposal systems; drainage and vent systems; fire protection. Room acoustics; sound amplification systems; sound isolation; mechanical noise control. Prerequisite: Junior standing in architecture. 2 hours.
- 257. Reinforced Concrete Theory.** Principle of reinforced concrete construction; theory of design of structural elements. Prerequisite: Architecture 246. 3 hours.

271. **Basic Design Studio, III.** An understanding of the nature of architectural design; form, structure, and function. Vocabulary; architectural scale, aerial perspective, modular construction, isometric projection, circulation, freehand drawing. Prerequisite: Architecture 172. 3 hours.
272. **Basic Design Studio, IV.** Continuation of Architecture 271. Prerequisite: Architecture 271. 3 hours.
283. **Architectural Practice.** Discussion of professional ethics and problems confronting the architect in the conduct of his business; procedure and control of work in the office and in the field; methods of making architectural estimates; contracts and contract documents; awarding of contracts. Prerequisite: Fifth-year standing in architecture. 2 hours.
288. **Man and Environment.** Emphasis on the need for planning for design for both professional and citizen participation in shaping communities and making them function effectively. The context is developed in the perspective of the exploding demands on the land of an expanding, affluent, technologically advanced, highly complex urban society in which value conflicts must be resolved. A basis for critical assessment of any community within a framework of high standards for attainable environmental excellence. Elective for all students except professional degree students in architecture, landscape architecture, and urban planning. 3 hours.
300. **Independent Studies in Urban Design.** The individual study of selected topics involving the history, design, and function of significant European cities. Prerequisite: One year of history of architecture or history of art; consent of instructor. 3 hours or 3/4 unit.
310. **Ancient Classical Architecture.** The development of architecture and urban design in the ancient Greek world and the Roman Empire. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
311. **Early Medieval Architecture.** The architecture and urban design of the Byzantine Empire, Slavic States, Islam, and Western Europe from the Early Christian to the Gothic era. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
312. **Gothic Architecture.** The development of architecture and urban design in Europe from the end of the Romanesque period to the Renaissance. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
313. **Italian Renaissance and Baroque Architecture.** The development of architecture, urban design, and garden art in Italy from the early fifteenth century to the late eighteenth century. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
314. **French Architecture, 1500-1800.** The development of architecture, urban design, and landscape architecture in France from the early sixteenth century to the late eighteenth century; French influence in the rest of Europe. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
315. **English and American Architecture.** Major architectural developments in Great Britain in the sixteenth, seventeenth, and eighteenth centuries; regional building traditions; sources and development of colonial architecture in America. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
316. **Architecture of the Nineteenth and Twentieth Centuries.** The development of architecture and urban design in Europe and the Americas from 1800 to the present with special consideration given to the influence of technology and urban conditions. Prerequisites: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or 3/4 unit.
317. **The Development of Contemporary Architectural Thought.** An examination of the philosophy of significant architectural writers and architects in relation to their projects and executed work. Those studied include Wright, Gropius, Le Corbusier, Mies van der Rohe, Ruskin, Pugin, Blondel, Laugier, Lodoli, Palladio, Alberti, and Vitruvius. Prerequisite: Architecture 211 and 212 or Art 111 and 112; consent of instructor. 3 hours or 3/4 unit.

323. **Social and Behavioral Factors for Design.** A research oriented introduction to existing social and behavioral knowledge, methods, and tools for relating man to his physical and social environment, with implications for theories and a philosophy of architectural design. Prerequisite: Consent of instructor. 3 hours or 3/4 unit.
326. **Impact of Technology on Design.** Studies of the effects of emerging technologies upon the development of the physical environment; examinations of alternative futures. Prerequisite: Consent of instructor. 3 hours or 3/4 unit.
330. **Architectural Practice.** Discussion of the role of the architect, the conduct of professional practice, professional ethics; office and business procedures; building economics and cost control; contracts and contract documents; legal aspects of professional practice and building construction; the administration of construction contracts and supervision of construction. Prerequisite: Architecture 232. 3 hours or 3/4 unit.
331. **Design Development and Construction Documents.** To be taken with Architecture 374. Network diagram scheduling of professional services; preliminary project investigations of site conditions and facilities, building law and economic considerations. The integration of materials, structure, mechanical equipment, illumination, and acoustics; design development outline specifications and drawings. The production planning, scheduling, and budgeting for working drawings and specifications; preparation of portions of these documents. Prerequisite: Architecture 330; registration in Architecture 374. 3 hours or 3/4 unit.
337. **Architectural Design.** Continued study of architectural design emphasizing complex site development and composition, and definitive design and refinement or detail for one of the plan components. Preparation of senior thesis program. Prerequisite: Architecture 236; senior standing in architecture. 7 hours or 2 units.
338. **Architectural Design.** Senior thesis. Individual research and comprehensive design solution of a selected architectural project, with special emphasis on site development and integration of structures and mechanical equipment, illumination, and acoustics. Prerequisite: Architecture 337. 7 hours or 2 units.
344. **Design Development and Construction Documents.** Continued design development and integration of architectural, structural, mechanical, and electrical work for a previously designed student project; application of building codes, production planning, and preparation of general construction working drawings and specifications. Prerequisite: Architecture 242 and 246. 2 hours.
347. **Theory of Structures.** Advanced problems in the analysis of statically determinate structures; general theories and methods of analysis of statically indeterminate structures; relationships between analysis and design of building frames. Prerequisite: Architecture 257; Mathematics 142. 5 hours or 1 1/2 units.
348. **Advanced Structures.** Advanced topics on design of structural members and connections. Analysis and design of continuous structures, rigid frames, and tall buildings. Prerequisite: Architecture 347; credit or registration in Architecture 358. 5 hours or 1 1/2 units.
351. **Theory and Design of Metal Structures.** Analysis and design of structures in metal. Beams; open web joists; metal deck; columns; riveted, bolted, and welded trusses; plate girders and connections; lateral loads and bracing; design of a simple steel frame building. Prerequisite: Architecture 252. 4 hours or 1 unit.
352. **Theory of Reinforced Concrete.** Concrete materials; behavior of reinforced concrete construction; behavior and design of structural elements, one-way slabs, beams, and girders; columns; A.C.I. Code requirements; introduction to continuity in reinforced concrete structures. Prerequisite: Architecture 351. 3 hours or 3/4 unit.
353. **Reinforced Concrete Design.** Selection, design, and comparison of reinforced concrete floor systems for buildings. Study and design of columns and footings. Prestressed concrete. Prerequisite: Architecture 352. 4 hours or 1 unit.
354. **Structural Planning.** General problems in the selection and design of structural systems for buildings; methods of analysis; site explorations, soils and foundations; bracing; special systems. Prerequisite: Architecture 353. 4 hours or 1 unit.

355. **Structural Analysis.** Advanced problems in the analysis of statically determinate structures. General theories and methods of analysis of statically indeterminate structures by geometric and energy methods. Introduction to theory of plastic design. Prerequisite: Architecture 353. 4 hours or 1 unit.
358. **Advanced Reinforced Concrete.** Reinforced concrete building design. Prerequisite: Architecture 247; credit or registration in Architecture 348. 3 hours or 1 unit.
371. **Architectural Design Studio, I.** Development of skills required in the design and representation of a complete architectural project; exercises in the design of the simplest architectural spaces and elements in relation to their next larger context of site and surroundings. Studio with two theory lectures per week. Prerequisite: Architecture 272 or consent of instructor. 5 hours, or 1 1/4 units.
372. **Architectural Design Studio, II.** Design of the simplest building types; relationships within the human habitat at the neighborhood scale; structural and tectonic integration; ecological and environmental influences. Studio with two theory lectures per week. Prerequisite: Architecture 371. 5 hours, or 1 1/4 units.
373. **Architectural Design Studio, III.** Design studies of intermediate size building types; planned communities; civic and social facilities at the community and urban scale. Collaboration among the several disciplines involved in planning the human habitat: urban planning, landscape architecture, sociology, and economics. Studio with two theory lectures per week. Prerequisite: Architecture 372. 6 hours or 1 1/2 units.
374. **Architectural Design Studio, IV.** Research and individual comprehensive design study for a selected architectural project. Special emphasis on site development and the integration of construction technology, structure, and environmental systems. Studio with two theory lectures per week. Prerequisite: Architecture 373; registration in Architecture 331. 6 hours or 1 1/2 units.
379. **Urban Housing.** A study of housing needs, comparative means of financing, comparative building types and costs, and contemporary examples of public and private housing in Europe and the United States. Prerequisite: Consent of instructor. 2 hours or 1/2 unit.
421. **Environmental Control.** Same as Mechanical Engineering 421. Design of environmental systems for buildings. Integration of mechanical, structural, and architectural demands, in lectures and through a semester design project. Prerequisite: Undergraduate courses in heat transfer and fluid mechanics. 1 unit.
431. **Theory of Architecture.** Examination and critical discussion of the changing purpose and role of architecture and of the relational structure among specialized areas of environmental design. Translation of insights and knowledge of non-design disciplines into information relevant to the understanding of architecture. Prerequisite: Consent of instructor. 1/2 unit.
432. **Architectural Criticism.** Analysis and criticism of selected buildings, building complexes, and urban environments. Individual reports and discussions. Prerequisite: Architecture 431 or consent of instructor. 1/2 unit.
433. **Architectural Design Methods.** Examination of the architectural design process; identification, investigation, and evaluation of design methods. Prerequisite: Consent of instructor. 1/2 unit.
435. **Advanced Architectural Design.** Advanced study of space relationships and other elements of architectural design from urban scale to that of individual buildings, including the integration of structural, mechanical, and interior design. Joint studies in urban design with graduate students in urban planning and landscape architecture. Prerequisite: Bachelor's degree in architecture (general option), or consent of instructor. 1/2 to 2 units.
452. **Advanced Theory and Design of Steel Structures.** Theory and design in bending, buckling, torsion, and combined stresses in beams and columns. Study in design and behavior of connections; composite constructions; light gauge steel construction analysis. Design and economy of simple and complex building frames. Prerequisite: Architecture 348 or consent of instructor. 1 unit.
454. **Advanced Structural Design in Reinforced Concrete.** Critical review of the methods

and specifications involved in the design and behavior for flexure, shear, bond, and anchorage; slab-beam-girder, ribbed joist, two-way and flat-slab floor construction; columns and footings; torsion; plastic theory of design; economy and continuity in building design. Prerequisite: Architecture 358 or consent of instructor. 1 unit.

456. **Matrix Methods of Structural Analysis.** Use of matrix mathematics and digital computers in the analysis of indeterminate structures by the displacement and force methods. Prerequisite: Computer Science 101 and Architecture 347, or consent of instructor. 1 unit.
481. **Architectural Practice and the Construction Industry.** Analysis of the construction industry and identification of those factors adversely affecting its development. Characteristics of, and relationships among, such components as architectural and engineering services, labor, contractors, manufacturers, building economics, governmental agencies, and research and testing agencies. Experts from these fields are invited to lead discussions on current problems and their solutions, on procedures adversely affecting the industry, and on current and needed areas of research. Prerequisite: Consent of instructor. 1/2 unit.
491. **Special Problems in Architectural Administration and Building Construction.** Individual or group research on approved subjects. Prerequisite: Credit or registration in Architecture 481. 1/2 to 2 units.
493. **Special Problems in Structural Theory and Design.** Individual or group investigation and study in architectural engineering application. Research in economy and design in correlation with architectural, mechanical, and structural requirements. Options: foundation design; prestressed concrete design; plastic design in steel; structural planning; operations research in integrated building systems; wood construction; architectural research laboratory; special research. Prerequisite: Consent of instructor. 1/2 to 4 units.
494. **Special Problems in Architectural Design.** Individual or group investigation of building types, theoretical problems, and other aspects of architecture. Options: design studio; building systems; architecture as a discipline; special research. Prerequisite: Architecture 435 or consent of instructor. 1/2 to 2 units.
496. **Special Problems in Architectural History.** Individual investigation of the work of particular architects, specific buildings, or the architecture of periods or regions, comparative studies; aesthetic problems. Prerequisite: Twelve hours of architectural history or consent of instructor. 1/2 to 2 units.

ART AND DESIGN

Head of Department: Professor J. R. SHIPLEY

Department Office: 143 Fine and Applied Arts Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major in the History of Art: Art 111 and 112, and at least twenty hours of advanced study selected from courses in the history of art and the history of architecture. French or German is strongly recommended to satisfy the requirement in foreign language.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each, if two are chosen: anthropology, Asian studies, English, history, Latin-American studies, medieval civilization studies, philosophy, psychology, sociology, speech, an approved sequence in the history of music, and ancient or modern language, excluding elementary courses 101 and 102.

105. **Introduction to Watercolor Painting.** Elementary watercolor sketching from landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.
106. **Introduction to Oil Painting.** Elementary oil painting and sketching from still life and landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours. Offered in the summer session only.

107. **Elementary Drawing.** Practical problems in elementary drawing as applied to solids, line drawing, light and shade, outdoor and studio sketching. For students not majoring in art. 2 hours. May be repeated for 2 additional hours.
111. **Introduction to Ancient and Medieval Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies previous to the Italian Renaissance. 3 hours.
112. **Introduction to Renaissance and Modern Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies beginning with the Italian Renaissance and continuing through the modern period. Prerequisite: Art 111 or consent of instructor for art students. 3 hours.
113. **Orientation to Art.** Information about the various fields of practice in the visual arts, elementary theoretical concepts; to enrich the student's knowledge of the visual arts and to broaden his appreciation of other art forms. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Registration in one of the following: Art 117, 118, 119, or 120, or consent of instructor. 1 hour.
114. **Orientation to Arts.** Continuation of Art 113. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Registration in one of the following: Art 117, 118, 119, or 120, or consent of instructor. 1 hour.
115. **Art Appreciation.** An introduction to the factors inherent in architecture, sculpture, painting, and the other arts. Primarily for non-art students. 3 hours.
116. **Masterpieces of Art.** A presentation of selected masterpieces of the visual arts, both as outstanding documents of culture and as great achievements in art. 2 hours.
117. **Drawing, I.** Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 3 hours.
118. **Drawing, II.** Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 117. 3 hours.
119. **Design.** Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 3 hours.
120. **Design.** Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 119. 3 hours.
121. **Drawing Theory.** Orthographic, oblique, isometric projections and perspective. 2 hours.
122. **Drawing Theory.** Continuation of Art 121. The science of shades and shadows in orthographic, oblique, isometric projections and perspective. Prerequisite: Art 121. 2 hours.
123. **Fundamentals of Drafting and Drawing.** Drawing techniques, lettering, projections, perspective, and special problems. Primarily for students in occupational therapy and home economics. Prerequisite: Consent of instructor. 3 hours.
125. **Life Drawing.** Prerequisite: Art 113, 114, and 118. 2 hours.
126. **Life Drawing.** Prerequisite: Art 125. 2 hours.
129. **Anatomy, I.** Lecture and studio practice in the skeletal and muscular structure of the human figure. Prerequisite: Art 118. 2 hours.
130. **Anatomy, II.** Continuation of Art 129. Prerequisite: Art 129. 2 hours.
131. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 113, 114, 118, 120, and 122. 2 hours.
132. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 131. 2 hours.
133. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Freshman standing in Art. 2 hours.
134. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Art 133. 2 hours.

141. **Still Life.** Painting in oil from arranged groups. Prerequisite: Freshman standing in art. 2 hours.
142. **Still Life.** Continuation of Art 141. Prerequisite: Art 141. 2 hours.
151. **Sculpture.** Anatomical and ornamental forms; plaster molds and models; wood and stone sculpture. Prerequisite: Art 118, 120, and 122, or Architecture 234. 2 hours.
152. **Sculpture.** Continuation of Art 151. Prerequisite: Art 151. 2 hours.
159. **Graphic Design Skills, I.** Graphic design laboratory projects emphasizing contemporary production and presentation techniques. Study of photographic, silkscreen, typographic, model making, and other processes unique to current professional demands. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. 2 hours.
160. **Graphic Design Skills, II.** Continuation of Art 159. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. 2 hours.
161. **Calligraphic Design.** A history and analysis of calligraphic form and its aesthetic and communicative potential. Application of fundamental design principles and the effect of color, line, and texture as organizational elements. Practice in the various calligraphic hands. Prerequisite: Sophomore standing in art. 2 hours.
162. **Letterform Design.** The history and use of the letter as a tool for verbal communication. Study of the typographic form and its construction and utilization. Practice ranges from indication of lettering through finished lettering, and includes organization of page, consideration of layout, readability, scale, texture, and color. Prerequisite: Sophomore standing in art. 2 hours.
175. **Design Methodology.** Introduction to logical methods and systems; review of current theory, investigation of quantitative factors in design. The application of systems theory to design problems; short problems; and required reading outside of class. Prerequisite: Sophomore standing. 2 hours.
185. **Design.** Composition in line, pattern, monochrome, and color. For non-art majors. 2 hours.
186. **Design.** Continuation of Art 185. For non-art majors. Prerequisite: Art 185. 2 hours.
188. **Individual Projects.** Individually directed projects in various media. Not open to students majoring in art. Prerequisite: Consent of instructor. 2 to 4 hours. May be repeated for a total of 6 hours.
190. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Credit is not given for both Art 190 and 203. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
191. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Prerequisite: Art 190. 2 hours.
192. **Metalwork and Jewelry, I.** A course in the design and execution of simple jewelry, flatware, and holloware, including study of the characteristics of base and precious metals and stones and working experience in the basic forming, decorating, jointing, and finishing processes. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
193. **Metalwork and Jewelry, II.** Advanced work in the design and production of jewelry, flatware, and holloware, with emphasis on the development of related or complicated pieces. Manipulative techniques are expanded and experimentation with materials and processes is encouraged. Prerequisite: Art 192. 2 hours.
194. **Pottery, I.** The design and production of pottery by hand methods. Work covers the basic processes of forming, decorating, and firing. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
195. **Pottery, II.** Advanced work in studio pottery, including expanded experience in forming methods and glaze compounds. Prerequisite: Art 194. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Senior Honors in Art.** For candidates for honors in art. Independent guided study and

research in a selected area of art. Prerequisite: Senior standing in art, a University grade-point average of 4.0, and approval of curriculum adviser and head of department. 2 to 5 hours. May be repeated to a total of 5 hours.

201. **Watercolor, I.** Prerequisite: Art 118 and 120. 2 hours.
202. **Watercolor, II.** Continuation of Art 201. Prerequisite: Art 201. 2 hours.
203. **Art in the Elementary Grades, I.** Introductory laboratory experiences with the elements of design in the visual arts and with processes, materials, and activities appropriate for the elementary grades. For non-art students only. Credit is not given for both Art 203 and 190. 3 hours.
204. **Art Education Laboratory.** Art in the secondary school. Creative activities in a variety of art materials appropriate for use in the high school. Class discussion on teaching techniques. Prerequisite: Art 132 or junior standing. 2 hours.
205. **Art in the Elementary Grades, II.** A continuation of laboratory experiences begun in Art 203 with processes, materials, and activities appropriate for the elementary grades. For non-art students only. Prerequisite: Art 203. 3 hours.
206. **Creative Art for Children.** Theories and techniques of teaching art to children. Supervised teaching experience with children required. Prerequisite: Junior standing in art education or consent of instructor. 3 hours.
207. **Art Curriculum Development and Practicum in the Elementary Schools.** The purpose of this course is (1) to develop productive and appreciative art curricula for the elementary schools and (2) to provide class members with a weekly half-day visitation to the local elementary schools to observe and assist classroom teachers and art consultants in teaching art to children. For art education majors only. 3 hours.
208. **Organization of Public School Art Programs.** The selection and arrangement of content for different educational levels; study and evaluation of curricula, equipment, and supplies; program supervision. Prerequisite: Art 207, junior standing in art, or consent of instructor. 3 hours.
209. **Japanese Arts Workshop.** The study and practice of the traditional Japanese arts: sumi-e (ink painting), ikebana (flower arrangement), and tea ceremony. Prerequisite: Sophomore standing. 2 hours.
210. **History of Furniture and Interior Design.** A historical study of furniture and interiors from the Renaissance to the present day. Special emphasis upon the American development and the contemporary scene with reference to its technological and historical background. Prerequisite: Art 134 or consent of instructor. 2 hours.
211. **The Art of Industrialized Society.** An examination of the art of contemporary Western society in relation to the philosophical, political, and physical forces which produced and were altered by the Industrial Revolution. Prerequisite: Junior standing or consent of instructor. 2 hours.
212. **Art of the Ancient Near East.** Survey of architecture, sculpture, and painting of the major areas of the Near East before the time of Alexander the Great, focusing on Egypt and Mesopotamia. 3 hours.
213. **African Art.** An investigation of the characteristics and achievements of outstanding phases of the art of Africa. Prerequisites: One year of history of art or consent of instructor. 3 hours.
215. **Basic Photography, I.** Basic investigation of elements comprising a photograph; exploration of the photogram, tone, texture, etc., as expressive media; work with the camera, exposure meter, film and print developing. Work is in black and white. Average cost to a student is \$100.00 plus the cost of the required 2 1/4 x 2 1/4 camera. (\$40.00 to \$75.00). Prerequisite: Junior standing in art or consent of instructor. 3 hours.
216. **Basic Photography, II.** Continued exploration of photography as a creative medium with investigation of light, multiple exposure, reflections, and form, etc. Emphasis is on self-expression of the individual student. Work is in black and white. Most equipment is furnished. Cost to students averages \$100.00. Prerequisite: Art 215. 3 hours. May be repeated, with consent of instructor, for an additional 3 hours.

217. **Greek Art.** Survey of architecture, sculpture, and painting of the Greek world from the Geometric period to the beginning of the Christian Era. 3 hours.
218. **Roman Art.** Survey of architecture, sculpture, and painting of the Roman world from Republican times to the age of Constantine, with brief treatment of later Roman art leading to Byzantine. 3 hours.
219. **Italian Renaissance Art.** Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. Prerequisite: One year of history of art or consent of instructor. 3 hours.
220. **Northern Renaissance Art.** Architecture, painting, sculpture, and minor arts of Europe outside Italy in the fifteenth and sixteenth centuries. Prerequisite: One year of history of art or consent of instructor. 3 hours.
221. **Art of the Nineteenth Century.** Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the nineteenth century. Prerequisite: One year of history of art or consent of instructor. 3 hours.
222. **Latin-American Art.** A study of the more important phases and periods of the visual arts of Latin America. Prerequisite: One year of history of art or consent of instructor. 3 hours.
223. **Italian Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in Italy in terms of major figures and dominant stylistic tendencies. Prerequisite: One year of history of art or consent of instructor. 3 hours.
224. **Northern European Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in the low countries, France, England, and Spain in terms of major figures and dominant stylistic developments. Prerequisite: One year of history of art or consent of instructor. 3 hours.
225. **Intermediate Drawing.** Study from life in drawing media. Prerequisite: Junior standing in art. 2 hours.
226. **Intermediate Drawing.** Continuation of Art 225. Prerequisite: Art 225. 2 hours.
231. **Intermediate Composition.** Prerequisite: Art 132. 3 hours.
232. **Intermediate Composition.** Prerequisite: Art 231. 3 hours.
233. **Advanced Composition.** Prerequisite: Art 232. 3 hours.
234. **Advanced Composition.** Prerequisite: Art 233. 3 hours.
235. **Illustration.** Problems in the design and execution of book and periodical illustration. Prerequisite: Art 132. 2 hours.
236. **Illustration.** Continuation of Art 235. Prerequisite: Art 235. 2 hours.
243. **Figure Painting.** Painting in oil from the head and full figure. Prerequisite: Junior standing in art. 2 hours.
244. **Figure Painting.** Continuation of Art 243. Prerequisite: Art 243. 2 hours.
245. **Advanced Painting and Drawing.** Advanced creative study from nature and the model in various painting and drawing media. Prerequisite: Art 226 and 244. 3 hours.
246. **Advanced Painting and Drawing.** Continuation of Art 245. Prerequisite: Art 245. 3 hours.
247. **Special Problems.** Special problems in technique, creative production and painting philosophy. Prerequisite: Senior standing in painting or consent of instructor. 2 hours.
248. **Special Problems.** Individually assigned studio projects. Students may be permitted to enroll in a maximum of two sections of this course simultaneously with different instructors during any semester. Prerequisite: Junior standing in art; consent of instructor. 2 to 4 hours. May be repeated for a total of 8 hours.
253. **Intermediate Sculpture, I.** A free, experimental, and creative use of permanent and impermanent sculpture materials; clays, wood, pastelines, and plasters. Prerequisite: Art 152. 2 hours.

254. **Intermediate Sculpture, II.** Special projects in stone carving and malleable sheet metal; lead, copper, brass, and aluminum. Prerequisite: Art 253. 2 hours.
255. **Sculpture Materials and Techniques, I.** Special projects for cast bronze; model preparations, investments, melting, pouring, chasing, and developing of patinas. Prerequisite: Art 152; junior standing in curriculum in sculpture. 3 hours.
256. **Sculpture Materials and Techniques, II.** Special projects in terra cotta; use of various clays; preparation and construction methods; special problems in casting methods and materials; kiln operation; fuels; glazing. Prerequisite: Art 255. 3 hours.
257. **Advanced Sculpture, I.** Introduction to plastics and welded metals; projects utilizing the special qualities of these materials. Prerequisite: Art 254. 2 hours.
258. **Advanced Sculpture, II.** Projects in permanent materials. Special attention is given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 257. 2 hours.
259. **Advanced Sculpture Materials and Techniques, I.** Projects in various permanent materials. Special attention is given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 256. 3 hours.
260. **Advanced Sculpture Materials and Techniques, II.** Continuation of Art 259. Prerequisite: Art 259. 3 hours.
262. **Sequential Visual Organization.** Organization of visual material sequentially, through specific problems and experiments incorporating time, space, and motion, accomplished through the use of multiple slide projection, the motion picture, and videotape. Prerequisite: Junior standing in graphic design curriculum. 2 hours.
263. **Reproduction Graphics.** Basic information and current practice in methods of producing multiple printed communication, including the preparation of artwork for the various methods of reproduction. Field trips required. Prerequisite: Junior standing in graphic design. 2 hours.
265. **Graphic Design, I.** Emphasis on the solving of basic visual communication problems on an applied level. Stress on understanding of symbol and image in evoking viewer response. Application of the findings of related fields such as sociology, communication, advertising, marketing, etc., as key factors affecting the solving of problems in design. Introduction to print film, display media, production methods, and the preparation of art work for reproduction. Prerequisite: Art 161 and 162 for graphic design majors; junior standing in art or consent of instructor for others. 3 hours.
266. **Graphic Design, II.** Continuation of Art 265. Prerequisite: Art 265. 3 hours.
267. **Graphic Design, III.** Further exploration of diverse design media and communication techniques. Strong emphasis on the multi-part design problem—the advertising campaign, corporate image program, educational and information material, display and exhibit design, and books and films. Group and team projects simulate actual practice, sometimes with students from other disciplines, and result in both verbal and nonverbal presentations. More concentrated involvement in problem definition and analysis and the encouragement of reappraisal of traditional media and methods. Prerequisite: Art 266. 3 hours.
268. **Graphic Design, IV.** Continuation of Art 267. Senior thesis. Preparation of portfolio. Prerequisite: Art 267. 3 hours.
269. **Senior Graphic Design Project.** Individually directed project in visual communication, emphasizing interdisciplinary approach and research methodology. Project definition and structure by student in consultation with advisers. Prerequisite: Senior standing in graphic design. 2 hours. May be repeated for 2 additional hours.
271. **Materials and Processes.** Use and manipulation of basic materials in modern industry. Prerequisite: Art 122 and 175. 3 hours.
272. **Materials and Processes.** Use and manipulation of basic materials in modern industry. Prerequisite: Art 271. 3 hours.
275. **Industrial Design.** Designing of objects for manufacture by the machine industries. Field trip required. Prerequisite: Art 122 and 175. 3 hours.

276. **Industrial Design.** Continuation of Art 275. Field trip required. Prerequisite: Art 275. 3 hours.
277. **Advanced Industrial Design.** Prerequisite: Art 276. 5 hours.
278. **Advanced Industrial Design.** Prerequisite: Art 277. 5 hours.
283. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
284. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Art 283. 2 hours.
285. **Lithography.** A studio course in lithography comprised of black and white and multiple color printing on both stones and metal plates. Work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
286. **Lithography.** A studio course in lithography comprised of black and white and multiple color printing on both stones and metal plates. Work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Art 285. 2 hours.
288. **Glassworking, I.** The design and production of glasswork by the offhand methods. Work covers the basic processes of blowing and molding. Prerequisite: Art 134; junior standing in art or consent of instructor. 2 hours.
289. **Glassworking, II.** Advanced work in glassworking by the off-hand methods including blowing, casting, fuming, and acid etching. Prerequisite: Art 288. 2 hours.
290. **Ceramic Raw Materials.** An introduction to the nature and understanding of basic inorganic raw materials in relation to ceramic processes. Laboratory testing of clay types, bodies, slips of earthenware, stoneware, and porcelain temperatures. Prerequisite: Liberal Arts and Sciences 141 and 142; junior standing in crafts curriculum—ceramic emphasis. 2 hours.
291. **Glaze Calculation.** Continued exploration of ceramic raw materials in relation to the compounding of glaze, including glaze calculation and systematic procedures for testing glaze; the understanding of various materials required to compound a glaze of a specific nature. Laboratory work at earthenware, stoneware, and porcelain temperatures. Prerequisite: Art 290; Liberal Arts and Sciences 141 and 142; junior standing in crafts curriculum—ceramic emphasis. 2 hours.
292. **Introduction to Metal Design in Jewelry.** Emphasis is placed on the basic techniques of cutting, forming, filling, soldering, and finishing of silver and other metals and materials. The design emphasis guides toward the development of forms appropriate to creative jewelry. A free and inventive approach to the use of new materials is encouraged, coupled with a respect for the fundamentals of craftsmanship. Prerequisite: Junior standing in curriculum in crafts. 3 hours.
293. **Development of Metal Design in Jewelry.** A course in the greater technical manipulation of tools and materials along with the designing of more complex challenging units of jewelry in silver, gold, and other materials. Casting, repousse, and other appropriate techniques serve to develop a greater three-dimensional emphasis. Prerequisite: Art 292. 3 hours.
294. **Ceramic Design, I.** An introductory course in ceramic design for developing basic skills in designing and producing clay products by various hand processes including throwing, handbuilding, and casting. Prerequisite: Junior standing in curriculum in crafts. 3 hours.
295. **Ceramic Design, II.** An introductory course in ceramic glaze calculation, concerned with the understanding and applying of the knowledge of glaze calculation in a creative way, and with applications of creative experiments in glaze and clay bodies. Prerequisite: Art 294. 3 hours.
296. **Decorative Metal Techniques.** A course in independent personal development in the techniques of chasing, engraving, filigree, inlaying, enameling, and lapidary design with

emphasis on linear and textural surface decoration as applied to small metal forms. Prerequisite: Art 293. 5 hours.

297. **Construction of Hollow and Flatware in Silversmithing.** A course for experiment and development in silver, bronze, copper, and other metals of hollow forms such as bowls, cups, tea and coffee servers. Work in flatware includes the design and construction of table services and other appointments. Prerequisite: Art 296. 5 hours.
298. **Ceramic Design, III.** The application of the combined skills of throwing and creative glaze procedures to produce thrown ceramic products with the emphasis on creative experimentation. Plaster and mold making as a creative procedure in producing clay products is covered. Prerequisite: Art 295. 5 hours.
299. **Ceramic Design, IV.** Technical and creative research in ceramic design, with emphasis on reappraisal of the traditional media and the traditional limited production method used by artist potters. Prerequisite: Art 298. 5 hours.
301. **Greek Painting.** Vase paintings, wall paintings, mosaics, and other examples of the graphic art of the Greek world from Mycenaean times through the Hellenistic period. Prerequisite: Art 217 or consent of instructor. 3 hours or 3/4 unit.
303. **Art of the Eastern and Western Roman Empire.** Deals with monuments outside Italy both in the eastern and western parts of the Empire. The influence of native traditions and the development of local styles is emphasized. Prerequisite: Art 218 or consent of instructor. 3 hours or 3/4 unit.
304. **Greek Sculpture.** A survey of the development of Greek sculpture from Mycenaean times to the Christian era with analysis of the major works in relief and in the round. Prerequisite: Art 217 or consent of instructor. 3 hours or 3/4 unit.
305. **Art of the Augustan Age.** A study of the major works of architecture, sculpture, and painting in Italy and the Roman Empire from the time of Augustus. Prerequisite: Art 218 or consent of instructor. 3 hours or 3/4 unit.
308. **Early Medieval Art.** The arts of Byzantine and of western Europe from the early Christian through the Romanesque period. Prerequisite: One year of art history or consent of instructor. 3 hours or 3/4 unit.
309. **Gothic Art.** The arts of western Europe from the end of the Romanesque period until the Renaissance. Prerequisite: One year of art history or consent of instructor. 3 hours or 3/4 unit.
311. **German and Austrian Painting of the Late Nineteenth and Early Twentieth Centuries.** A survey of modern German and Austrian painters and pictorial movements from the 1890's to the period of Hitler, with special emphasis on the expressionist period. Prerequisite: Art 321 or 322, or one 300-level course in nineteenth-century painting. 3 hours or 3/4 unit.
312. **The Art Nouveau in Europe.** A survey of the principal artists and artistic currents in the applied arts during the 1890's in Europe. Emphasis is on individual figures, with an attempt to define the common stylistic and theoretical assumptions of the period. Prerequisite: Art 321, or one 300-level course in nineteenth-century art or architecture. 3 hours or 3/4 unit.
313. **Problems in Italian Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of Italy during the Renaissance are selected for intensive study. Special emphasis is given to the study of the lives of artists and problems in style or iconography. Prerequisite: Art 219 or consent of instructor. 3 hours or 3/4 unit.
314. **Problems in Northern Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of France, Germany, Spain, and England during the Renaissance is selected for intensive study. Special emphasis is given to the study of the lives of the artists and problems in style or iconography. Prerequisite: Art 220 or consent of instructor. 3 hours or 3/4 unit.
316. **Later Chinese Painting.** A study in depth of later phases of Chinese painting, particularly that of the Ming and Ch'ing dynasties; connoisseurship in Chinese painting. Prerequisite: Art 328, a course in Chinese history of the period covered, or consent of instructor. 3 hours or 3/4 unit.

317. **Italian Art of the Sixteenth Century.** Painting, sculpture, and minor arts in Italy from 1520 to 1590. Prerequisite: One year of history of art or consent of instructor. 3 hours or 3/4 unit.
321. **Twentieth-Century Art in Europe: 1900–1914.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on the first. Prerequisite: One year in the history of art or consent of instructor. 3 hours or 3/4 unit.
322. **Twentieth-Century Art in Europe: 1915–1945.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on the first. Prerequisite: One year in the history of art or consent of instructor. 3 hours or 3/4 unit.
323. **American Art to 1840.** Architecture, painting, sculpture, and minor arts of the Colonies and the United States to 1840. Prerequisite: One year of history of art or consent of instructor. 3 hours or 3/4 unit.
324. **American Art: 1840–1900.** Architecture, painting, sculpture, and minor arts of the United States. Prerequisite: One year of history of art or consent of instructor. 3 hours or 3/4 unit.
325. **Recent American Painting and Sculpture.** Current developments, with special emphasis on works shown in contemporary exhibitions at the Krannert Art Museum. Prerequisite: One year of history of art or consent of instructor. 3 hours or 3/4 unit.
326. **Art of Medieval Japan.** A study of Japanese art, primarily painting, from the thirteenth century, with emphasis on the work of individual artists. Prerequisite: Art 327, a course in Japanese history of the period covered, or consent of instructor. 3 hours or 3/4 unit.
327. **Japanese Art.** History of Japanese art from earliest times to the twentieth century. Prerequisite: One year of history of art or junior standing. 3 hours or 3/4 unit.
328. **Chinese Art.** History of Chinese art from earliest times to the present. Prerequisite: One year of history of art or junior standing. 3 hours or 3/4 unit.
330. **Oceanic Art.** A survey of traditional art in Polynesia, Melanesia, and Micronesia, including New Zealand and Australia. Emphasis is on major style areas and their historical and cultural significance. Prerequisite: One year of history of art or consent of instructor. 3-hours or 3/4 unit.
331. **West African Art.** A study in depth of West African art styles in time perspective and cultural context, with a special interest in the use of interdisciplinary source materials. Prerequisite: Art 213 or consent of instructor. 3 hours or 3/4 unit.
332. **The Ancient Ideal in Art and Literature.** Same as Classical Civilization 332. A study of the aesthetic standards and theories of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit.
335. **Romantic Art.** A study of English, French, and German art from the end of the eighteenth century through 1840. Focuses on revivalist movements, historicism, landscape art, and changing conceptions of art and artist during the period. Prerequisite: Art 221 or consent of instructor. 3 hours or 3/4 unit.
336. **Realism to Post-Impressionism.** A study of European art from 1850 to 1900, with emphasis on French painting. Prerequisite: Art 221 or consent of instructor. 3 hours or 3/4 unit.
340. **Historiography of Art and the History of Art Criticism.** Origins and the development of the history of art criticism. Prerequisite: A year of study in the history of art or consent of instructor. 3 hours or 3/4 unit.
380. **Drawing.** Advanced drawing in several media. Prerequisite: For undergraduates, consent of instructor; for graduates, consent of departmental graduate committee. 2 hours, or 1/2 to 1 unit.
381. **Painting.** Advanced painting in oil and other media. Not open to candidates for the M.F.A. in painting. Prerequisite: Art 142 or equivalent; for graduate students, consent of departmental graduate committee. 2 to 4 hours, or 1/2 to 1 unit. May be repeated to a total of 2 units.

382. **Painting Materials and Techniques.** Study of the materials and techniques used in the various media; oil, watercolor, tempera, gouache, encaustic, etc. Prerequisite: Art 142 or graduate standing in art. 2 hours or 1/2 unit.
383. **Print Media.** Advanced work in various printmaking techniques. Not open to candidates for the M.F.A. in painting. Prerequisite: Art 284 or equivalent; for graduate students, consent of departmental graduate committee. 2 hours, or 1/2 to 1 unit.
385. **Lithography.** Laboratory course in lithography. Course of study includes a complete development of the process, exploiting its potential as a fine art medium. Prerequisite: Art 286; for graduate students, consent of departmental graduate committee. 2 hours, or 1/2 to 1 unit.
387. **Photography.** Emphasis on development of mature creative attitudes, through use of personal images and interpretations. Work in black and white and in color. Prerequisite: Art 216 or equivalent; consent of instructor. 3 hours, or 1/2 to 1 unit. May be repeated for a total of 6 hours or 2 units.
388. **Cinematography.** Theory and practice of motion pictures as an art form. Emphasis is on individual creative production. The average cost of the second semester is \$200.00. Prerequisite: Art 215; consent of instructor. 3 hours, or 1/2 to 1 unit. May be repeated to a total of 6 hours or 2 units.
390. **Advanced Art for Elementary Grades.** Advanced laboratory experiences in two-dimensional visual art techniques for elementary teachers, supervisors, and principals. Prerequisite: Art 205 or consent of instructor. 2 hours or 1/2 unit. May be repeated for a total of 4 hours or 1 unit.
391. **Advanced Sculpture Techniques.** Advanced work in various sculptural media. Prerequisite: Art 252 or equivalent. 2 hours, or 1/2 to 1 unit.
392. **Silversmithing, I.** An advanced course in the design and execution of holloware, dealing primarily with raising and spinning methods and with the decorative processes of chasing, repousse, niello, filigree, and inlay. Prerequisite: Consent of instructor. 2 hours, or 1/2 to 1 unit.
393. **Silversmithing, II.** An advanced course in the design and execution of flatware and holloware, dealing primarily with forging and seaming methods, engraving and tool-making. Prerequisite: Consent of instructor. 2 hours, or 1/2 to 1 unit.
394. **Ceramic Design.** Ceramic design with emphasis on the development of professional style and personal expression. Prerequisite: Art 295 or consent of instructor. 2 to 4 hours, or 1/2 to 2 units. May be repeated to a total of 6 hours.
395. **Glass Design.** Advanced glass design with emphasis on professional development and personal style. Prerequisite: Art 289 or consent of instructor. 2 to 4 hours, or 1/2 to 1 unit.
450. **Seminar in Modern Art.** Investigation of special problems in the history of twentieth-century art. Students present reports of their research. Prerequisite: Consent of instructor. 1 unit.
451. **Studies in American Art.** Investigation of special problems; historical development of the study of American art; techniques of conservation and restoration. Prerequisite: Consent of instructor. 1 unit.
452. **Seminar in Chinese Art.** Investigation of selected phases, concepts, and problems of the art of China; intensive reading and reports. Prerequisite: Art 328 or consent of instructor. 1 unit.
453. **Seminar in Japanese Art.** Investigation of selected phases, concepts, and problems of the art of Japan; intensive reading and reports. Prerequisite: Art 327 or consent of instructor. 1 unit.
454. **Seminar in Ancient Art.** Research seminar in problems selected from the art of the ancient Mediterranean area. Prerequisite: At least one of the following: Art 304, 305, 306, 307, or equivalent. 1 unit.
455. **Seminar in Baroque Art.** Research seminar in problems selected from the art of seventeenth-century Europe. Prerequisite: Art 319, 320, or equivalent; or consent of instructor. 1 unit.

456. **Seminar in the Art of the Period 1750–1900.** An intensive study of selected problems in European art. Prerequisite: Consent of instructor. 1 unit. May be repeated to a total of 3 units.
457. **Studies in Medieval Art.** Research seminar in subjects selected from the art and architecture of the Medieval period in western Europe. Prerequisite: Art 308 or 309; effective reading knowledge of French or German; consent of instructor. 1 unit.
458. **Seminar: African Art.** An intensive investigation of selected problems in the sculpture and other arts of Negro Africa. Prerequisite: Consent of instructor. 1 unit.
459. **Seminar in Renaissance Art.** Special problems in the history of Renaissance art. Prerequisite: Graduate standing; consent of instructor. 1 unit.
467. **Graphic Design Laboratory.** Individually directed research in problems of visual design with emphasis on the understanding of recent developments in nonverbal communication and the utilization of contemporary graphic processes. Prerequisite: Enrollment in the M.F.A. program in graphic design or consent of departmental graduate committee. 1 to 3 units.
477. **Industrial Design Laboratory.** Individually directed research in the drafting room or workshop with concentration in industrial design. Prerequisite: Enrollment in the M.F.A. program in industrial design or consent of departmental graduate committee. 1 to 3 units.
490. **Curriculum Development in Art.** An analysis of curriculum organization in the visual arts. Particular emphasis is given to a range of curriculum positions in education and general research related to curriculum design. Prerequisite: Consent of instructor. 1 unit.
491. **Special Problems.** Individual direction in research and in creative activity; thesis. 1/2 to 2 units.
492. **Individual Readings in History of Art.** Directed readings in special fields or aspects of history of art not provided in depth by the current course offerings. Prerequisite: Consent of instructor. Sections A and B may be taken simultaneously. Registration allowed for each section is 1/2 to 1 unit.
493. **Seminar: Introduction to Methods and Criticism.** Prerequisite: Graduate standing in art. 1/4 to 1 unit.
494. **Seminar: Studies in the Development of Art History and Criticism.** The relation of art history and criticism: changing standards and criteria; intensive reading of selected critical works; the writing of art criticism. Prerequisite: Consent of instructor. 1 unit.
495. **Painting Laboratory.** Professional and experimental painting with emphasis on the development of maturity of style and personal expression. Prerequisite: Enrollment in the M.F.A. program in painting and printmaking or consent of departmental graduate committee. 1/2 to 3 units.
496. **Sculpture Laboratory.** Experience at a professional level in sculptural techniques including metals casting, welding, stone carving, wood carving, clay modeling, and ceramic sculpture, with emphasis on the development of creative achievement. Prerequisite: Enrollment in the M.F.A. program in sculpture or consent of departmental graduate committee. 1 to 3 units.
497. **Print Workshop.** Intaglio, relief, and planographic; printing, including etching, engraving, aquatint, wood, paper, and plastic relief printing, and lithography. 1/2 to 3 units.
499. **Thesis Research.** Guidance in research and writing theses for advanced degrees. Prerequisite: Graduate standing in history of art or art education. 0 to 4 units.

ASIAN STUDIES

(Including Chinese, Indonesian, Japanese, Korean, Persian, and Sanskrit)

Director of Center for Asian Studies: Professor R. B. CRAWFORD

Center Office: 1208 West California Avenue, Urbana

This program is sponsored and administered by the Center for Asian Studies. Students in all colleges and schools of the University who desire a knowledge of Asian affairs and cultures are invited to consult, either directly or through their advisers, with the Center Director and faculty associated with the Center in order to develop course programs suited to their individual needs and objectives. Under the National Defense Education Act, the Center is designated a center for Asian language and area studies. The program is described in the Undergraduate Study catalog under the interdepartmental majors and minors of the College of Liberal Arts and Sciences.

Note: All 200-level language courses and Chinese 301 and 302 and Japanese 301 and 302 are open to freshmen.

Asian Studies

199. **Undergraduate Open Seminar.** 0 to 9 hours.
202. **Interdisciplinary Proseminar in Asian Studies.** Directed individual research on topics relating to the various Asian areas. Prerequisite: Consent of instructor. 4 hours.
295. **Readings Course.** Directed readings in the languages and literatures of East Asia, South Asia, Southeast Asia, or the Near East. The area selected depends on the student's interest. Prerequisite: Consent of instructor. 2 to 4 hours.
303. **Japanese Society.** Same as Sociology 303. The institutions of contemporary Japan and their historical roots, the Japanese approach to modernization and development and social change. Implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
345. **Tutorials in Special Asian Languages.** Tutorials at the elementary, intermediate, and advanced levels in special Asian languages not regularly offered are available with the consent of the Director of the Center for Asian Studies. May be repeated up to six semesters successively, but no more than four units of graduate credit may be accumulated. Graduate credit is given only for work beyond the elementary level. Prerequisite: Consent of Director of the Center for Asian Studies. 5 hours or 1 unit.
450. **Seminar in Asian Studies.** Seminar on selected topics in Asian and Middle Eastern topics. The topic will vary with the instructor and the seminar may be repeated up to three units. Prerequisite: Consent of instructor. 1 unit.
490. **Individual Study and Research in Special Topics.** Supervised individual investigation or study of a topic not covered by regular course offerings. The topic selected by the student and the proposed plan of study must be approved by his Asian Studies curriculum adviser and the staff members who supervises the work. Prerequisite: Consent of instructor. 1 to 3 units.

Chinese

201. **Elementary Chinese, I.** An introduction to Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Chinese, II.** Second term of spoken Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor,

and formal grammar based on conversational materials. Work on written Chinese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 201. 5 hours.

203. **Intermediate Chinese, I.** First term of second year of the Chinese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 202 or 301, or equivalent. 5 hours.
204. **Intermediate Chinese, II.** Concentration on ability to engage in fluent discourse, on comprehensive grammatical knowledge, and on ability to read ordinary simple text in Chinese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 203 or equivalent. 5 hours.
207. **Chinese Literature in Translation, I.** An introductory survey of Chinese literature and its cultural and historical background from earliest times to the end of the T'ang. No knowledge of Chinese is required. 3 hours.
208. **Chinese Literature in Translation, II.** An introductory survey of Chinese and its cultural and historical background from the end of the T'ang to the present. No knowledge of Chinese is required. Prerequisite: Chinese 207 or consent of instructor. 3 hours.
301. **Intensive Chinese, I.** Intensive introduction to the spoken and written Chinese language. Emphasizes the introduction of basic vocabulary and sentence patterns. This course is equivalent to Chinese 201 and 202. For all students who have no previous Chinese and who want to learn at a rapid rate. 10 hours or 2 units.
302. **Intensive Chinese, II.** Continuation of Chinese 301. Emphasizes conversation and reading. This course is equivalent to Chinese 203 and 204. Prerequisite: Chinese 202, 301, or equivalent. 10 hours or 2 units.
303. **Advanced Chinese, I.** Advanced instruction in Chinese with emphasis on reading. Prerequisite: Chinese 204 or 302. 5 hours or 1 unit.
304. **Advanced Chinese, II.** Advanced instruction in Chinese with emphasis on reading. Prerequisite: Chinese 303. 5 hours or 1 unit.
305. **Advanced Readings in Modern Chinese, I.** Reading and translation of graded selections from modern Chinese literary and journalistic writing. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
306. **Advanced Readings in Modern Chinese, II.** Reading in modern Chinese literary and journalistic writings. Introduction to classical Chinese to prepare students of modern Chinese to understand classical forms and quotations in vernacular text and to use dictionaries and reference works. Prerequisite: Chinese 305 or equivalent. 3 hours or 1 unit.
307. **Introduction to Literary Chinese.** An introduction to literary language, style, and structural patterns as reflected in the Confucian Classics and other literary, philosophical, and historical texts. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
308. **Readings in Literary Chinese.** Readings in texts selected from the Confucian Classics and other literary, philosophical, and historical texts. Attention is given to linguistics and intellectual patterns and to problems of translation. Prerequisite: Chinese 307 or equivalent. 3 hours or 1 unit. May be repeated for credit up to 9 hours or 3 units.
309. **Social Science Readings in Chinese.** Reading and translation of selected Chinese texts in the social sciences with emphasis on specialized terminology and prose style. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit. May be repeated for credit up to 9 hours or 3 units.
310. **Modern Chinese Literature.** Reading and analysis of selected works of Chinese literature since the May 4 Movement with special attention to the relationship between literature and ideology in twentieth-century China. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
311. **Traditional Chinese Fiction in Translation.** Reading and analysis of representative pieces of Chinese fiction from the fourth century B.C. to 1900 with emphasis on the

development of Chinese fiction, its place in the literary tradition, and its role in society. No knowledge of Chinese is required. 3 hours or 1 unit.

312. **Modern Chinese Literature in Translation.** Readings and analysis of representative selections from Chinese literature since the May 4 Movement, with special attention to the relationship between literature and ideology in twentieth-century China. No knowledge of Chinese is required. 3 hours or 1 unit.
320. **Readings in Chinese and Japanese Buddhist Texts.** Same as Japanese 320. Readings in selected Buddhist philosophical, religious, and historical literature in Chinese and Japanese. Prerequisite: Chinese 304 or Japanese 304, or consent of instructor. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Japanese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
350. **Research Methods and Bibliography in Chinese Studies.** Introduction to the problems of translation and to the variety, nature, structure, and usage of Chinese reference works. Exercises are assigned involving application of research methods peculiar to Chinese studies and the use of the appropriate reference aids. Prerequisite: Chinese 307 or consent of instructor. 3 hours or 1 unit.

Indonesian

201. **Elementary Indonesian, I.** An introduction to Indonesian, including conversation with a native Indonesian-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Indonesian, II.** Second term of spoken Indonesian, including conversation with a native Indonesian-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Indonesian. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Indonesian 201. 5 hours.
303. **Intermediate Indonesian, I.** First term of second year of the Indonesian language, drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite Indonesian 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Indonesian, II.** Concentration on ability to engage in reasonably fluent discourse in Indonesian, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Indonesian. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Indonesian 303 or equivalent. 5 hours or 1 unit.

Japanese

150. **Introduction to Japanese Culture.** A topical introduction to Japanese cultural and aesthetic life with attention to cultural and aesthetic patterns as they are reflected in literature, language, and the arts. 3 hours.
201. **Elementary Japanese, I.** An introduction to Japanese, including conversation with a native Japanese-speaking tutor under the direction of the linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Japanese, II.** Second term of spoken Japanese, including conversation with

a native Japanese-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Japanese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 201. 5 hours.

203. **Intermediate Japanese, I.** First term of second year of the Japanese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 202, Japanese 301, or equivalent. 5 hours.
204. **Intermediate Japanese, II.** Concentration on ability to engage in reasonably fluent discourse in Japanese, on comprehensive views of formal grammar, and on ability to read simple ordinary written Japanese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 203 or equivalent. 5 hours.
205. **Japanese Literature in Translation, I.** A survey of Japanese literature from earliest times to around 1600 A.D. Readings in prose, poetry, and drama in English translation. 3 hours.
206. **Japanese Literature in Translation, II.** A survey of Japanese literature from around 1600 A.D. to recent times. Readings in prose, poetry, and drama in English translation. Lectures and papers. 3 hours.
301. **Intensive Japanese, I.** An intensive introduction to spoken and written Japanese. Emphasis is placed on basic grammatical patterns and vocabulary. This course is equivalent to Japanese 201 and 202. For students who have no previous Japanese and who want to learn at a rapid rate. 10 hours or 2 units.
302. **Intensive Japanese, II.** Continuation of Japanese 301. Emphasis on conversation and reading. This course is equivalent to Japanese 203 and 204. Prerequisite: Japanese 202 or 301, or equivalent. 10 hours or 2 units.
303. **Advanced Japanese, I.** Formerly Japanese 305. A course for advanced knowledge of Japanese, with emphasis on reading. Prerequisite: Japanese 204 or 302, or equivalent. 5 hours or 1 unit.
304. **Advanced Japanese, II.** Formerly Japanese 306. A course for advanced knowledge of Japanese, with emphasis on reading. Prerequisite: Japanese 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Readings in Modern Japanese, I.** Reading and translation of selected texts in modern Japanese. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit.
306. **Advanced Readings in Modern Japanese, II.** Continuation of Japanese 305. Reading and translation of selected texts in modern Japanese. Prerequisite: Japanese 305 or equivalent. 3 hours or 1 unit.
309. **Social Science Readings in Japanese.** Readings in Japanese social science materials, including articles from newspapers, periodicals, and learned journals. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit. May be repeated for credit up to 9 hours or 3 units.
310. **Modern Japanese Literature.** Reading and analysis of selected Japanese texts, primarily fiction. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit.
320. **Readings in Chinese and Japanese Buddhist Texts.** Same as Chinese 320. Readings in selected Buddhist philosophical, religious, and historical literature in Chinese and Japanese. Prerequisite: Japanese 304 or Chinese 304, or consent of instructor. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Korean

201. **Elementary Korean, I.** Introduction to spoken Korean. Students are taught to speak and understand basic conversational Korean or graded lessons and intensive drill with a native tutor under the direction of a linguist-instructor. Exclusive use of Hankul (Korean script). 5 hours.
202. **Elementary Korean, II.** Continuation of Korean 201. Further conversational Korean, introduction of formal grammar based on conversational materials. Some work on Hanc'a (Chinese characters). Prerequisite: Korean 201. 5 hours.
303. **Intermediate Korean, I.** Second year of Korean. More drill for advanced conversational fluency. Introduction to a greater variety of styles and levels of discourse and usage. Prerequisite: Korean 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Korean, II.** Continuation of Korean 303. Concentration on ability to engage in fluent discourse, and to read ordinary text. Increasing study of grammar and more Hanc'a. Prerequisite: Korean 303 or equivalent. 5 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Persian

201. **Elementary Persian, I.** Introduction to Persian, including conversation with a native speaker under the direction of an instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Persian, II.** Continuation of Persian 201, with introduction of more advanced grammar and with emphasis on more fluency in speaking and reading. Prerequisite: Persian 201 or equivalent. 5 hours.
205. **Introduction to Persian Culture and Literature, I.** A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
206. **Introduction to Persian Culture and Literature, II.** Continuation of Persian 205. A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
303. **Intermediate Persian, I.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, composition, and practice in speech. Prerequisite: Persian 202 or consent of instructor. 5 hours or 1 unit.
304. **Intermediate Persian, II.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, composition, and practice in speech. Prerequisite: Persian 303 or consent of instructor. 5 hours or 1 unit.
305. **Advanced Persian, I.** Designed to improve competence in speaking, writing, and reading Persian. Includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 304 or consent of instructor. 3 hours or 1 unit.
306. **Advanced Persian, II.** Continuation of Persian 305. Designed to improve competence in speaking, writing, and reading Persian. Includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 305 or consent of instructor. 3 hours or 1 unit.
309. **Contemporary Persian Literature and Western Influence.** Reading in modern Persian literature in translation, and the study of selected European novels and works on literary theory with specific attention to Western influence on Persian literature. Prerequisite: Consent of instructor. 3 hours or 1 unit.

Sanskrit

201. **Elementary Sanskrit, I.** Introduction to Sanskrit, treating in full the grammar of the language as preparation for reading, and including the reading sections of the Mahabharata. 5 hours.
202. **Elementary Sanskrit, II.** Continuation of Sanskrit 201. Introduction to Sanskrit, treating in full the grammar of the language as preparation for reading, and including the reading of sections of the Mahabharata. 5 hours.
309. **Introduction to Sanskrit Literature in English Translation.** The course focuses on different forms of Sanskrit literature in English translation with emphasis on drama, poetry, and poetics 3 hours or 1 unit.

ASTRONOMY

Head of Department: Professor I. IBEN, JR.

Department Office. 103 Observatory

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in astronomy excluding Astronomy 101. Physics courses at the 300 level may be substituted for astronomy courses to the extent of six hours as part of the major.

Minors: Twenty hours which must include Physics 106, 107, and 108. The remaining eight hours may be taken in physics or in one of the following subjects: chemistry, geology, mathematics, philosophy. If two subjects are chosen, at least eight hours must be taken in each.

Note: Individual instruction is provided for superior undergraduate students at hours to be arranged.

101. **Descriptive Astronomy.** Introductory survey of the universe; structure and motions of the earth and moon; planetary motions; physical nature of the planets; comets and meteors; origin and evolution of the solar system. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210 or 300. Not open to those students who have had two or more semesters of college physics. 4 hours.
102. **Descriptive Astronomy.** The stars; distances, motions, dimensions; atoms and radiation; structure, origin, and evolution of stars; structure of the Milky Way; galaxies and the structure of the universe. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210 or 300. Prerequisite: Astronomy 101. 4 hours.
110. **Selected Topics in Astronomy.** For students who have an interest in astronomy and wish to examine various aspects of the science in more detail than is possible in Astronomy 101 or 102. Topics vary from semester to semester. No credit is given toward major requirements in astronomy. Not open to students with credit in Astronomy 210. Prerequisite: Astronomy 102. 2 hours.
210. **General Astronomy.** A survey of astronomy for students having some background in physics. The approach is primarily descriptive, but mathematical techniques are used where needed. The chief topics are orbits and gravitation; the bodies of the solar system; the nature and evolution of the stars; galaxies; and the structure of the universe. Credit is not given to students who have credit in Astronomy 101, 102, or 300. Prerequisite: Two semesters of college physics. 3 hours.
300. **Astronomy for Teachers.** A general course in astronomy designed for teachers which includes classical astronomy, modern developments, and aspects of the space program. Available curriculum materials for elementary and secondary teaching are discussed and some practice is given in telescopic observation. No credit is given to students with credit in Astronomy 101, 102, or 210, or to astronomy majors. 4 hours or 1 unit. Graduate credit is given only to students in elementary and secondary teacher training programs.

301. **Introductory Astrophysics.** Stars: observational data and their determination; atoms and radiation; stellar atmospheres; equilibrium of stellar interiors; special types of stars; inter-stellar matter. Prerequisite: Physics 108. 3 hours or 1 unit.
302. **Astrophysics of the Sun.** Observations of the sun at all wavelengths and application of the results to the study of photosphere, chromosphere, and corona; structure of the atmosphere of the quiet sun; solar activity. Prerequisite: Astronomy 301. 3 hours or 1 unit.
306. **Foundations of Mechanics and Gravitational Theory.** Same as Aeronautical and Astronautical Engineering 306. Introduction to the dynamics of particles and rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectile relative to earth, precession of earth's axis, etc. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
307. **Celestial Mechanics.** Two-body problem; Kepler's equation; planet's orbit in space; distance in solar system; gravitational potential; perturbations in planetary motion; dynamical theory of stars of high velocity; spiral arm of galaxy. Prerequisite: Astronomy 306 or Physics 322. 3 hours or 1 unit.
314. **Observational Astronomy.** Astronomical coordinate systems and transformations; theory of, and practice in, approximate and precise determinations of latitude, longitude, and time; introduction to theory of errors; theory and practice of astronomical photography. Prerequisite: Astronomy 102 or 210 or Civil Engineering 201; Mathematics 140, 141, or 145. 4 hours or 1 unit.
315. **Observational Techniques and Reductions.** Methods of observation and reductions in photographic and photoelectric photometry, spectrophotometry, and stellar radial velocity determinations. Prerequisite: Astronomy 102 or 210; Mathematics 140, 141, or 145. 4 hours or 1 unit.
317. **Elements of Magnetohydrodynamics.** Same as Aeronautical and Astronautical Engineering 317. Equation of magnetohydrodynamics, single-fluid and multiple-fluid models, magnetic interaction parameters, magnetosonic waves, hydromagnetic shock waves, aligned-field and cross-field flows, theory of characteristics, MHD acceleration, generation, and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit.
321. **Stellar Systems, I.** Galactic structure: the observational data; stars in the solar neighborhood; the solar motion; stellar statistics and distribution; stellar populations; interstellar matter and spiral structure; the whole galaxy. Prerequisite: Astronomy 102 or 210; Physics 108. 3 hours or 1 unit.
322. **Stellar Systems, II.** Continuation of Astronomy 321. Galactic dynamics: stellar motions; galactic rotation; dynamics and mass distribution; stellar encounters; dynamics of interstellar matter. Galaxies: distances, structural features; groups and clusters; radio galaxies and quasars; spatial distribution and motions. Prerequisite: Astronomy 321. 3 hours or 1 unit.
357. **Radio Astronomy.** Same as Electrical Engineering 357. Instrumental theory and observational techniques; radar and meteors; the moon and planets; solar radio waves; galactic and extragalactic radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit.
366. **Aeronomy: Physics of the Upper Atmosphere and Space.** Same as Physics 366. Structure and composition of the earth's upper atmosphere; the ionospheric layers; planetary atmospheres; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.
401. **Stellar Atmospheres.** Physical characteristics of stellar atmospheres as derived from spectroscopic observations; radiation transfer, theory and observations of the continuous spectrum, limb darkening; formation of absorption lines, line profiles, curves of growth, relative chemical abundances; emission features; forbidden radiation. Prerequisite: Consent of instructor. 1 unit.
403. **Gaseous Nebulae and the Interstellar Medium.** Distribution, structure, and spectra of nebulae; physical processes in planetary and diffuse nebulae; recombination, fluores-

cent, and forbidden line radiation; determination of physical parameters; nature of the interstellar medium; interstellar gas and grains; observation of interstellar medium. Prerequisite: Astronomy 301. 1 unit.

404. **Theory of Stellar Structure.** Masses, luminosities, radii, and surface temperature of stars; basic equations and stability conditions; nuclear reactions; integration of basic equations; results—initial stages, later stages, white dwarfs. Prerequisite: Consent of instructor. 1 unit.
415. **Experimental Methods in Radio Astronomy.** Design and construction of instruments for radio astronomy; techniques of observation of celestial radio sources; interpretation of data. Prerequisite: Consent of instructor. 1 unit; may be taken a second time for credit.
424. **Relativity and Cosmology.** Same as Mathematics 460 and Physics 424. Elements of tensor calculus and Riemannian geometry; special relativity; Lorentz transformations, equivalence of mass and energy; general relativity and the gravitational field of the sun; galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit.
433. **Solar System Astrophysics.** Planetary orbits and perturbations; physical perturbations; physical parameters of the planets; planetary interiors, atmospheres, magnetospheres, and surface layers; the satellites; asteroids and comets; meteors, meteorites, and tektites; interplanetary grains and gas; problems of origin and evolution. Prerequisite: Consent of instructor. 1 unit.
486. **Constitution of the Ionosphere: An Introduction to Aeronomy.** Same as Electrical Engineering 486. Properties of the neutral and ionized atmosphere above 60 kilometers height, and the photochemical processes causing them; diffusion of ionospheric constituents; solar and meteoric perturbations of the ionosphere. Prerequisite: Graduate standing in electrical engineering, physics, or astronomy; Mathematics 341 or equivalent. 1 unit.
491. **Seminar in Special Topics.** 0 to 4 units. Prerequisite: Consent of instructor.
499. **Thesis Research.** 0 to 3 units.

ATMOSPHERIC SCIENCES

Director of Atmospheric Research Laboratory: Professor Y. OGURA

Laboratory Office: 5-111 Coordinated Science Laboratory

301. **Introduction to Theoretical Meteorology.** Introduces the student to the basic physics and mathematics that are necessary to do research in meteorology. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
302. **Principles of Atmospheric Dynamics.** An introduction to those elements of fluid dynamics and thermodynamics which are essential to understanding the large and small scale motions of neutral atmosphere. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
401. **Weather Analysis.** Describes the workings of the real atmosphere by giving the student practical experience in weather analysis, with emphasis on physical interpretation. The methods and procedures of weather analysis by numerical processes, in particular methods of deducing vertical motions, are also reviewed. Prerequisite: Atmospheric Sciences 301 and 302. 1 unit.
405. **Simulation of Atmospheric Dynamics—Numerical Techniques.** Intended to give the student practical numerical techniques for solving those linear and nonlinear differential equations which appear frequently as initial and boundary value problems in hydrodynamics and dynamic meteorology. Prerequisite: Mathematics 287 and 343, or consent of instructor. 1 unit.
406. **Simulation of Atmospheric Dynamics—Physical Aspects.** Intended to describe the principles and methods of simulating and predicting large-scale atmospheric motions on

the basis of hydrodynamics and thermodynamics. Prerequisite: Atmospheric Sciences 302. 1 unit.

- 490. **Individual Study.** Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor. 1/2 to 2 units.
- 491. **Seminar in Atmospheric Sciences.** Seminar on topics of current interest. Subjects are announced in the Time Table. Prerequisite: Consent of instructor. 0 to 1 unit.
- 497. **Special Topics in Atmospheric Sciences.** Lecture course in topics of current interest. Subjects such as the general circulation, physical meteorology, upper atmosphere dynamics, atmospheric convection, atmospheric turbulence and boundary layers, dynamic oceanography, and advanced topics in atmospheric dynamics are covered in semester offerings on a regular basis. Prerequisite: Consent of instructor. 1 unit.

AVIATION

Director of Institute of Aviation: R. E. FLEXMAN

Institute Office: Terminal Building, University of Illinois-Willard Airport

- 100. **Orientation to Aviation.** Provides a general survey of the history of flight in light of the systems and methods of operation used by modern aviators. Practice in using flight systems consists of one-third of the course utilizing simulators and airplanes; two-thirds is devoted to lecture and analysis. Ten hours of simulator time are included in the training, followed by six hours of in-flight training, two of which are actual control manipulation. 3 hours.
- 101. **Private Pilot.** Prepares the beginning flight student for an F.A.A. Private Pilot certificate. Airplane utility and safety are emphasized. Forty-eight classroom hours of ground school instruction on Federal Aviation Regulations, air navigation, radio communications, weather, general operation of airplanes, and safety practices; thirteen hours of flight discussion; eleven hours of flight simulator training; and thirty-one hours of flight training in various makes of airplanes. 3 hours.
- 105. **Soaring, I.** A basic soaring course for those with no previous flight experience. An aviation recreational course covering regulations, navigation, meteorology, aerodynamics, launching, and flight maneuvers required for glider operation. Includes approximately twenty dual flights, five solo flights, and eight hours of ground discussion. 1 hour.
- 115. **Soaring, II.** An intermediate soaring course for those with any power flight certificate or previous soaring experience equivalent to Aviation 105. This course offers additional experience and knowledge preparatory to glider pilot certification. It includes approximately ten dual flights, fifteen solo flights, and eight hours of ground discussion. Prerequisite: Aviation 105 or equivalent. 1 hour.
- 120. **Secondary Flight.** The second phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. The purpose is to develop further the qualities of a good pilot, broaden experience, and introduce advanced maneuvers. Forty-eight classroom hours of ground school instruction in meteorology and aircraft engines, and forty-four hours of flight training (sixteen dual and twenty-eight solo) in two-place and four-place airplanes. Prerequisite: Aviation 101 or Private Pilot certificate; consent of Director. 3 hours.
- 130. **Intermediate Flight.** The third phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. Emphasis is placed on cross-country, night, and instrument flying. Forty-eight classroom hours of ground school instruction in cross-country planning and in-flight procedures, including navigation and radio communications, and forty-three hours of training (seventeen dual, twenty-one solo, and five flight simulator) in two-place side-by-side radio-equipped aircraft. This course may be taken by private pilots who wish to increase their cross-country and night-flying proficiency. Prerequisite: Aviation 101 or Private Pilot certificate; consent of Director. 3 hours.

140. **Advanced Flight.** The final phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. Emphasis is placed on precision flying. Forty-eight classroom hours of ground school instruction including general operation of airplanes and a review of Federal Aviation Regulations, navigation, radio communications, meteorology, and aircraft engines in preparation for a Commercial Pilot certificate, and forty-four hours of flight training (fourteen dual and thirty solo) in two-place tandem monoplanes or four-place monoplanes. Prerequisite: Aviation 120 and 130; consent of Director. 3 hours.
142. **Powerplant Theory.** A study of reciprocating and turbine internal combustion aircraft engines. Included are history and development of powered flight, advances in thermodynamics and metallurgy, and improvements in volumetric and mechanical efficiencies. Also included is a study of supporting systems and design variations for all types of aircraft engines in use. 4 hours.
143. **Aircraft Materials and Processes, I.** Theory and practice in the techniques of precision measurement safetying, and nondestructive inspection. Identification and use of materials suitable for aircraft construction. 2 hours.
144. **Powerplant Theory Laboratory.** An application of the principles of construction, theory of operation and airworthiness criteria as introduced in Aviation 142. Includes maintenance procedures and engine operation for both piston and turbine powerplants. Prerequisite: Credit or registration in Aviation 142. 2 hours.
145. **Aircraft Physics.** A study of the basic physical principles that apply to present day aerospace vehicles. Course work includes AC and DC theory, power sources, transmission, measurement, solid state devices, and troubleshooting problems existing on aircraft electrical circuits. 3 hours.
147. **Introduction to Federal Aviation Regulations.** A study of regulations, directives, and specifications governing the manufacture, operation, and maintenance of aircraft, and the control of air traffic, as well as the qualifications and certification of personnel and equipment engaged in aircraft operation and maintenance. 3 hours.
152. **Powerplant Systems, I.** Theory and operating principles of the ignition, starting, and electrical power generating components and systems used with aircraft turbine and reciprocating powerplants. Prerequisite: Aviation 142 and 145. 4 hours.
153. **Aircraft Materials and Processes, II.** A survey of materials used in the manufacture of structural components of aerospace vehicles. Emphasis is placed on the sources, manufacturing processes, physical properties, and working characteristics of various ferrous and nonferrous metals. 2 hours.
154. **Powerplant Systems, II.** Theory of operation, design, and maintenance procedures. For fixed pitch and controllable propellers. Includes a study of propeller governing and control systems for reciprocating and turboprop engines. Prerequisite: Aviation 145. 3 hours.
155. **Aircraft Mathematics.** Arithmetic fundamentals and their application to the field of aviation mechanics; included are wing rib layout, bend allowance, load factors, weight and balance, engine thrust and horsepower, and fuel and oil consumption problems. 3 hours.
156. **Powerplant Systems, III.** An introduction to fuels and fuel systems as related to aircraft turbine and reciprocating powerplants. A study of fuel system functions including carburetion, fuel injection, fuel management, and supercharging. Prerequisite: Aviation 142 and 145. 3 hours.
157. **Powerplant Conditioning and Testing.** A study of powerplant malfunction, diagnosis and maintenance procedures, materials, and equipment. It includes condition monitoring techniques and some of the economic aspects of powerplant maintenance. Prerequisite: Aviation 152 and 156. 7 hours.
159. **Powerplant Inspection and Regulations.** A study of Federal aviation regulations, advisory circulars, airworthiness directives, and manufacturers' publications as they apply to aircraft powerplants. It includes a survey of specialized inspection techniques and equipment for both destructive and non-destructive inspection procedures. 3 hours.
163. **Aircraft Materials and Processes, III.** A survey of nonstructural materials used in the construction of aircraft components. The sources, manufacturing processes, physical

properties, and working characteristics of synthetics, fabrics, composites, woods, and their associated surface treatments are studied in detail. 3 hours.

165. **Aircraft Fabricating Processes, I.** Procedures and techniques of mechanical, non-fusion attachment; sheet metal forming; use of adhesives, bonded materials, and plastics in aircraft component fabrication. Laboratory experiences include the use of mechanical fasteners, similar and dissimilar metal assembly, and plastic and bonded structure fabrication. Prerequisite: Aviation 143, 153, and 155. 4 hours.
167. **Aircraft Fabricating Processes, II.** Fusion and adhesion procedures and techniques including gas, AC and DC arc, and inert gas processes. Laboratory experiences include fusion and adhesion processes with representative metals used in the aircraft industry. Prerequisite: Aviation 143 and 153; General Engineering 105. 2 hours.
169. **Aircraft Systems, I.** A study of basic principles and design concepts of the environmental and life support systems used in modern aircraft. Representative systems for pressurization, oxygen, heating, cooling, and ice and fire protection are studied with detailed emphasis on individual components and their relationship to the complete system. Prerequisite: Aviation 145. 4 hours.
170. **Aircraft Systems, II.** Electrical distribution circuits and associated lighting, power, communication, navigation, and instrumentation systems common to modern aircraft. Emphasis is placed on circuit analysis and performance testing. Prerequisite: Aviation 145, 152, and 155. 5 hours.
172. **Aircraft Systems, III.** Includes hydraulic and pneumatic power systems as utilized in modern aircraft. Theory of operation, design concepts, component relationships, and malfunction diagnosis are primary areas of course content. Prerequisite: Aviation 145. 3 hours.
174. **Aircraft Assembly and Inspection.** Aircraft assembly, configuration, and alignment consistent with associated aerodynamics theory. Structure and systems inspection and F.A.A. regulations related to the achievement of maximum safety of aircraft are studied. Prerequisite: Aviation 163, 165, 167, 170, and 172. 5 hours.
181. **Introduction to Electronic Theory and Practices.** DC and AC circuitry; series, parallel, and combination circuits; Ohm's and Kirchhoff's laws; conductors, insulators, and circuit-controlling devices; laboratory experience in the use and care of tools in the fabrication of sub-assemblies and simple circuits. 3 hours.
182. **Basic Electronic Theory.** Characteristics of alternating current; time-varying circuits; analyzing behavior of alternating current components; phase and power factor; power measurement; integrating circuits; differentiating circuits and other miscellaneous alternating circuits; principles of vacuum tubes and transistors. Prerequisite: Aviation 181. 3 hours.
183. **Advanced Electronic Theory.** Timed circuits and circuits for power supplies, detectors, amplifiers, oscillators; ultra-high frequencies and microwaves; principles of radar and microwave systems; time-constant and pulse-forming circuits; locking, switching, and sweep circuits. Prerequisite: Aviation 182. 3 hours.
184. **Aircraft Navigation and Communications Systems.** Very-high and ultra-high frequency receiving and transmitting equipment; instrument landing systems; navigation systems including direction finding, distance measuring, and surveillance radar. Prerequisite: Aviation 183 or consent of instructor. 5 hours.
185. **Aircraft Electrical Systems.** Circuit tracing, testing, trouble-shooting, and adjusting; includes ignition, power generating and regulating, engine and flight instruments, lighting, heating, pressurizing, and warning systems. Prerequisite: Aviation 181. 5 hours.
186. **F.A.A. and F.C.C. Regulations.** A study of the publications and regulations of the Federal Aviation Administration and the Federal Communications Commission, including the design, construction, installation, servicing, repair, and operation of ground and airborne electrical and electronic equipment. 3 hours.
188. **Aircraft Instrumentation.** Installation and servicing of airborne electrical and electronic components and ground test equipment. Prerequisite: Aviation 183. 3 hours.
200. **Basic Instrument Flight Techniques.** First course in preparing the commercial pilot for

- an F.A.A. instrument rating. Forty-eight classroom hours of ground school instruction in theory of instrument flight, airplane instruments and instrument systems, navigation, meteorology, and Federal Aviation Regulations; twenty to twenty-two hours of simulated instrument flight; ten to twelve hours of instrument flight simulator training. Prerequisite: Commercial Pilot certificate or equivalent flight experience; junior standing; consent of Director. 3 hours.
- 210. Advanced Instrument Flight Procedures.** Second and final course leading to an F.A.A. instrument rating. Forty-eight classroom hours of ground school instruction in pre-flight planning and in-flight procedures, including use of instrument flight publications, navigation, meteorology, and air traffic control procedures; twenty to twenty-five hours of simulated instrument flight; ten to twelve hours of instrument flight simulator training. Prerequisite: Aviation 200 or forty hours of simulated instrument flight experience; junior standing; consent of Director. 3 hours.
- 220. Flight Instructor.** Prepares the commercial pilot for an F.A.A. Flight Instructor certificate. Forty-eight classroom hours of ground school instruction on techniques of flight instruction and theory of flight, and a minimum of twenty-five hours of flight training (twenty-five hours dual; two hours dual in GAT; GAT practice teaching, three hours) in four-place aircraft. Prerequisite: Commercial Pilot certificate; junior standing; consent of Director. 3 hours.
- 222. Instrument Flight Instructor Course.** This course leads to an instrument instructor's rating on the student's flight instructor certificate. Includes five hours of simulator, ten hours of flight, and one hour of flight check time. The course includes refresher on chart symbol interpretation, Federal Air Regulations, communications, instrument construction and operation, and electronic aids to navigation. Designed to include obtaining a flight instructor instrument rating. Prerequisite: Commercial Pilot certificate; instrument rating; flight instructor certificate; airplane rating; consent of Director. 1 hour.
- 230. Nondestructive Inspection Methods.** The theory and practice of nondestructive inspection methods as they apply to aircraft. Included in the various methods are magnetic particle, dye penetrant, ultrasonic, eddy current, spectrometric, and radiographic inspection procedures. Laboratory experience is included where practical without violating normal safety precautions. 3 hours.
- 250. Practice Teaching, Airplane.** Practice teaching using classroom, audio-visual material, simulator, and airplane. Prepares the certified flight instructor to teach in all modes of aviation education. A minimum of two hours of classroom lecture, twenty hours of simulator instruction, and six hours of airplane instruction is given by the student. An additional twenty hours of classroom lecture received clarifies and explains the proper method of successful instruction. Prerequisite: Aviation 220 or Flight Instructor certificate; junior standing; consent of Director. 3 hours.
- 280. Special Rating (Multi-Engine Land).** Prepares the commercial pilot for an F.A.A. multi-engine land airplane rating. Sixteen hours of ground school instruction and nine hours of flight training in a multi-engine land airplane. Prerequisite: Commercial Pilot certificate; consent of Director. 1 hour.
- 291. Special Ratings and/or Specialized Flight.** Prepares the commercial pilot for special F.A.A. pilot certificates and/or ratings such as seaplane, airline transport pilot, and helicopter, and specialized flight such as advanced multi-engine operation. Sixteen hours of preflight (ground school) instruction and variable flight instruction as selected by the student. Options are advanced multi-engine, helicopter, and airline transport pilot. Registration in this course is limited to professional students with approval of Director through the Chief of Pilot Training. Prerequisite: Commercial Pilot certificate; consent of Director. 1 hour.

BANDS

Director: Professor H. BEGIAN

Department Office: 140 Band Building

Note: All band courses are open to men and women students who have been accepted by examination, with assignments being made according to proficiency and instrumentation. Completion of each course involves, in addition to the regular schedule of rehearsals, participation in the public appearances of the bands.

101. **Symphonic Band—Large.** The Symphonic Band (Large) maintains a complete symphonic band instrumentation for the study and performance of all types of band literature. 1 hour.
102. **Symphonic Band—Small.** The Symphonic Band (Small) maintains a complete small symphonic band instrumentation for the study and performance of band literature intended for the smaller instrumentation. 1 hour.
103. **First Concert Band.** The First Concert Band maintains the instrumentation of the standard band and serves as a training organization for the Symphonic Bands. The literature studied and performed is of the very highest calibre and is technically difficult. 1 hour.
104. **Second Concert Band—A.** The Second Concert Band enrolls those who do not at first qualify for positions in the other bands, until they become eligible for promotion as improvement is shown and vacancies occur. The band literature studied is of high quality but is technically less difficult than the music for the top three bands. 1 hour.
105. **Second Concert Band—B.** The Second Concert Band enrolls those who do not at first qualify for positions in the other bands, until they become eligible for promotion as improvement is shown and vacancies occur. The band literature studied is of high quality but is technically less difficult than the music for the top three bands. 1 hour.
106. **Marching Band.** The Marching Band prepares and performs at least six shows per football season. The music used is of the best quality available for this type of service activity. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

Biochemistry

(See Chemical Sciences)

Biology

(See Life Sciences)

Biophysics

(See Life Sciences)

Botany

(See Life Sciences)

BUSINESS

299. **International Business Study in Absentia.** Upon prior written approval of his adviser, his major department, and the College of Commerce and Business Administration office, a student may earn up to eighteen credit hours per semester undertaking a study and/or research project in international business away from the Urbana-Champaign campus. The student's major department verifies the satisfactory progress of the work by means of interim and final written reports, written or oral examinations, or other means

established by his major department. While absent from the Urbana-Champaign campus, the student must continue to pay all fees required by the University of Illinois to retain continuity of enrollment, and to allow the time spent away from this campus to count toward residency. Prerequisite: The student must be a commerce major in good standing who has completed at least forty-five semester hours toward a bachelor's degree with at least one semester in residence at the University of Illinois. 0 to 18 hours. This course may be repeated for a maximum of 36 credit hours, all of which must be earned within 12 consecutive months.

BUSINESS ADMINISTRATION

Head of Department: Professor K. P. UHL

Department Office: 350 Commerce Building (West)

101. **Business Administration.** The aim of this course is to encourage the student to use and to develop further his ability to listen, to read, and to think for himself, and to formulate, express, and support his own conclusions in the subject areas of economics and business administration. 3 hours.
190. **Motivation and Responsibility in Business.** Formerly Business Administration 110. A seminar directed to an investigation of goals, restraints, and responsibilities in American business. Open only to freshman participants in the program for honors students in a department or college of the University. Prerequisite: Participation in an honors program. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **The Legal Environment of Business.** Includes an examination of the nature of law and the formation and application of legal principles; the role of law in society; the legal environment in which business operates, particularly government taxation, and the regulation of commerce, competition, and labor-management relations; and the concept of property, its creation, transfer, and importance to our business society. Prerequisite: Economics 102; Accountancy 105; junior standing. 3 hours.
201. **Basic Principles of Business Law.** Basic principles of business law, including the law of contracts, agency, business organizations, and bankruptcy. Credit is not given for both Business Administration 201 and 261. Prerequisite: Economics 102; Accountancy 105; junior standing. 3 hours.
202. **Principles of Marketing.** A course emphasizing the marketing concepts of planning, organization, control, and decision-making from the viewpoint of the business executive. Credit is not given for both Business Administration 202 and 272. Prerequisite: Economics 172 or equivalent. 3 hours.
203. **Principles of Business Law.** Contracts, the Uniform Commercial Code, creditors' rights, agency and employment, business organizations and property. Prerequisite: Business Administration 200. 4 hours.
206. **Marketing Environment.** Attention is given to the relationship of firm to firm, to government, to labor, and to other organized groups or institutions as they interact with the marketing function of the firm. Emphasis is placed on the importance of marketing operations on cultural, political, and social forces, and how these forces affect the alternatives considered and the decision methods used by marketing management. Prerequisite: Business Administration 202. 3 hours.
210. **Management and Organizational Behavior.** A general analysis of management and organizational behavior from a systems point of view, considering both formal and informal structures. Environmental forces; planning, decision, and control processes; motivation, incentives, and leadership are discussed. Students will not receive credit for both Business Administration 210 and 247. Prerequisite: Junior standing. 3 hours.

212. **Retail Management.** The fundamentals of buying, sales promotion, pricing, control, and store finance. Prerequisite: Business Administration 202. 3 hours.
247. **Introduction to Management.** Summary of management in a modern industrial enterprise. Emphasis is placed on motivation, small group behavior, and the problems of designing and operating a formal organization structure. For non-commerce students only. Prerequisite: Sophomore standing. 3 hours.
248. **Personnel Management.** A study of the nature, scope, and objectives of personnel management, especially within the industrial organization. Includes brief history of the development of the personnel department and its relationships with other departments in the implementation of the personnel management function; considers the contribution of several disciplines to personnel research and management; provides practical knowledge of personnel policies and techniques in such areas as recruitment, selection, training, development, and compensation. Open to non-commerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.
249. **Human Relations.** The interrelationships of individuals and groups within the work environment of an industrial organization; motivation and communication for work and cooperation between managers and different economic and social groups; qualifications and practices of the successful manager. Open to non-commerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.
261. **Summary of Business Law.** Basic principles of the private law of business, including the law of contracts, agency, and business organizations. A brief introduction to the law of sales, commercial paper, security devices, and property. Credit is not given for both Business Administration 261 and 201. Open to both commerce and non-commerce students. Prerequisite: Junior standing. 3 hours.
272. **Industrial Selling.** Formerly Marketing 272. A survey course in marketing and salesmanship for non-commerce students interested in selling industrial products. Credit is not given for both Business Administration 272 and 202. 3 hours.
290. **Human Values and Business Behavior.** This course is designed to compel tomorrow's business leaders to develop reasoned viewpoints on critical issues and to sharpen their analytical skills in evaluating a variety of viewpoints on a diversity of topics. The aim is to contribute to more effective business leadership and community citizenship. Open to advanced undergraduate honors students in the University. Prerequisite: Advanced standing, James Scholar, or participant in a departmental honors program. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
301. **The Law of the Uniform Commercial Code.** A continuation of the private law of business dealing with significant phases of the law of commercial transactions under the Uniform Commercial Code—sales, commercial paper, bank collections, and deposits, bulk transfers, and security devices. Also included is the law of bailments, suretyship, and security in real property. Prerequisite: Business Administration 201 or 261; senior standing. 3 hours, or 3/4 or 1 unit.
302. **Wills, Estates, and Trusts.** A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. Prerequisite: Business Administration 200, 201, or 261; senior standing. 3 hours, or 3/4 or 1 unit.
314. **Production.** An introduction to production management, consideration of major problems of the production area, and the use of quantitative methods for solving them. Prerequisite: Business Administration 321 and 374, or consent of instructor. 3 hours or 1/2 unit.

- 315. Management in Manufacturing.** The application of production concepts and quantitative techniques to actual industrial problems. The mathematical structure of the particular production problems and the general structure of the production system and its interaction with marketing and budgeting. Areas include inventory control, production processes, programming and production control; forecasting of production levels, simulation of the production system, and physical planning of industrial plants. Prerequisite: Business Administration 314. 3 hours or 1/2 unit.
- 320. Marketing Research.** An investigation of the development and applicability of information systems techniques to marketing problems. The marketing management process is analyzed; the underlying concepts related to the information needed to serve the process are explored; and the incorporation of information resources into the management function is demonstrated. This course covers the use of behavioral sciences, research methods, social processes, and structure influences upon marketing activities, demographic variables, application of Bayesian decision theory, studies of promotional activity, simulation and programming models, planning models, and strategy formulation models which provide an analytical structure for the solution of marketing problems. Prerequisite: Business Administration 202. 3 hours or 1/2 unit.
- 321. Organizational Behavior.** Same as Labor and Industrial Relations 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environment; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 200, 202, and 210; Finance 254; or consent of instructor. 3 hours, or 1/2 to 1 unit.
- 323. Industrial Social System.** Understanding of complex organizations, particular attention to ways of dividing work, achieving coordination, and issues connected with change and adaptation. Prerequisite: Business Administration 321 and 374; Psychology 201; students specializing in production must also complete Business Administration 314 and 315. 3 hours, or 1/2 to 1 unit.
- 337. Promotion Management.** Designed to enable the student, through directed and supervised investigation of selected psychological, economic, and sociological problems, to become acquainted with the methods of demand analysis and its application to the interrelationships of marketing management, advertising management, and sales management. Discussion of communication theory as it relates to the goals and means of winning patronage for the firm. Emphasis is put on the effect, or control, of the communication process. Class discussion focuses upon literature in demand stimulation and communications and the testing of relevant hypotheses. Credit is not given for both Business Administration 337 and Advertising 281. Prerequisite: Business Administration 320 and 344. 3 hours or 1/2 unit.
- 344. Consumer Behavior.** An analysis of consumer motivation, buying behavior, market adjustment, and product innovation, including a survey of explanatory theories of consumer market behavior and producer reactions. This course covers behavioral aspects of the marketing process from the producer to ultimate user, or consumer. Fundamentals of product planning, development, engineering, and promotion are viewed as part of the total marketing program. Normative models of the decision-making process for winning patronage in intermediate, industrial, and consumer markets are considered. The decision-making process by consumers is evaluated with reference to psychological drives used by producers, middlemen, and consumers. Prerequisite: Business Administration 321 and 374. 3 hours or 1/2 unit.
- 351. Personnel Administration.** A study of concepts and methods used by the staff personnel unit in building and maintaining an effective work force in an industrial organization. Development of ability to design the personnel subsystem within the firm and to deal effectively with problems encountered in such areas as recruitment selection, training, and wage and salary administration. Considerable emphasis upon case analysis, role playing, and research. Credit is not given for Business Administration 351 and Psychology 245 and Industrial Administration 448 or 449. Prerequisite: Business Administration 323; Economics 173 and 240. 3 hours, or 1/2 to 1 unit.

352. **Pricing Policies.** The essential nature of marketing decisions and pricing, marketing, organization and the pricing process, price theories, and pricing models. Contributions of operations research and behavioral sciences to pricing analysis. The relationship of pricing objectives, methods, strategies, and policies to market behavior and the goals of the firm. Prerequisite: Business Administration 320 and 344. 3 hours or 1/2 unit.
353. **Industrial Relations Administration.** An investigation of union-management relations, primarily at the company level, for those planning careers in the industrial labor relations field. Topics include grievance handling, disciplinary policies and procedures, arbitration and contract negotiations. Emphasis on role playing techniques. Credit is not given for Business Administration 353 and Business Administration 448 or 449. Prerequisite: Business Administration 323 or 351; Economics 240. 3 hours, or 1/2 to 1 unit.
360. **Business Logistics.** The ecology, analysis, and development of integrated distribution systems. The application of quantitative tools, economic analysis, transportation and marketing management in the analysis, and interpretation and design of the physical flow of goods through marketing network alternatives. Attention is given to the theory of market structures, transport networks, location, and cost control. Consideration is also given to site selection, warehousing, inventory management, logistic communications networks, and data control models. Prerequisite: Business Administration 320 and 344, or consent of instructor. 3 hours or 1/2 unit.
370. **International Marketing.** The role of enterprise, comparative marketing and transport institutions and systems, and comparative marketing organizations and systems of administration in selected foreign countries and the United States. The managerial and operational problems of world enterprise with emphasis on the role of ethnic and cultural differences in influencing marketing strategy. Prerequisite: Business Administration 320 and 344, or consent of instructor.
373. **Electronic Data Processing for Business.** A course in the fundamentals of business data processing. The use of modern electronic computers in the areas of accountancy, economics, management, marketing, and general business is considered. The facilities of the Digital Computer Laboratory are utilized in the course. Prerequisite: Business Administration 321 and 374.
374. **Operations Research.** Introduction to methods of operations research from an executive or managerial viewpoint, emphasizing formulation of business problems in quantitative terms; industrial applications of linear programming, dynamic programming, game theory, probability theory, queueing theory, and inventory theory. Prerequisite: Business Administration 200, 202, and 210; Economics 173; Finance 254; or consent of instructor. 3 hours, or 1/2 to 1 unit.
375. **National Income and Business Forecasting.** Same as Economics 375. The significance of national income and related economic accounts for analysis and forecasting of business conditions. Develops the interrelations between data systems used by government agencies and business concerns in program planning and current decision making. The use of models for solving problems in this area is introduced. Prerequisite: Economics 103 or 108; Economics 171 (for business majors, Business Administration 321 and 374). 3 hours, or 1/2 or 1 unit.
380. **Management Science in Marketing.** The appraisal and diagnosis, organization and planning, action and control of commodity and product-service distribution, marketing analysis and systems, and demand stimulation. A survey of normative models for decision-making in a variety of marketing situations and systems. Introduction to the behavioral theory of the firm and its application to different marketing targets, institutional settings, or market arrangements. Discussion of the various analytical tools available to firms for appraising, diagnosing, organizing, planning, and formulating market strategies. Principles of behavioral sciences and quantitative techniques are emphasized. A terminal course that integrates the analysis of a wide range of marketing problems and situations. Prerequisite: Business Administration 320 and 344, or consent of instructor. 3 hours or 1/2 unit.
389. **Business Policy.** Analyzes policy formulation and implementation from a company-wide standpoint. Integration of knowledge and approaches across functional areas is

stressed. Emphasis is placed on both endogeneous and exogeneous factors which affect company policies and on the role of the firm in society. The student must complete all the requirements of the department's undergraduate program before registering for this course; students planning to continue their education can petition for an exemption in this course. Credit is not given for both Business Administration 389 and 544. Prerequisite: Business Administration 321 and 374; all the requirements of areas of concentration; senior standing. 3 hours or 1/2 unit.

401. **Scientific Management, I.** Same as Industrial Engineering 401. A study of modern management principles on the basis of methods, concentrating on such operations research techniques as nonlinear and dynamic programming and queueing theory. Prerequisite: Industrial Engineering 386 and Mathematics 361, or consent of instructor. 1 unit.
402. **Scientific Management, II.** Same as Industrial Engineering 402. A systems approach to industrial problems involving inventory control, scheduling and line balancing, maintenance and investment theory; application of formally accumulated knowledge of operations research techniques. Problems from industry are assigned to small teams of students. Prerequisite: Business Administration 401; background in computer technology or consent of instructor. 1 unit.
405. **Marketing Theory and Systems.** A detailed study of macro- and micro-marketing systems and the various approaches to marketing theory; attention is given to general systems theory, the nature of marketing systems, system adaptation to the environment, concepts of theory, and major approaches to macro- and micro-theory in marketing. 1 unit.
406. **Development of Marketing Thought.** The emphasis in this course is placed on an analysis of marketing thought from the late 1800s to the present. Although attention is directed primarily to general marketing and marketing management, consideration is also given to major contributions in selected areas of marketing. The literature and scholars selected are evaluated both as reflections of their times and as contributions or contributors to contemporary thought. Prerequisite: Business Administration 405. 1 unit.
407. **Comparative Marketing Systems.** Examination of comparative marketing systems. Topics include specification and identification of structural elements of systems, analysis of static and dynamic properties, methods of analyzing systems such as input-output and flow analysis, the role of marketing in comparative economic systems, and the role of marketing in developing economics. Prerequisite: Business Administration 405. 1 unit.
408. **Foundations of Behavioral Science for Administration.** Fundamental behavioral concepts and theory having administrative applications are developed and integrated. Initially, the focus is on the individual decision-maker. The perspective is enlarged to include interpersonal, organizational, and social structures and influences. Strategies and methods of research on behavioral applications in business are developed. Credit is not given for both Business Administration 408 and 510. 1 unit.
410. **Organizational Sciences, I.** Same as Political Science 460, Psychology 453, and Sociology 456. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or consent of instructor. 1 unit.
411. **Organizational Sciences, II.** Same as Political Science 461, Psychology 454, and Sociology 457. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Business Administration 410. 1 unit.
415. **Foundations of Consumer Behavior.** A study of basic factors influencing consumer behavior. Attention is focused on psychological, sociological, and economic variables,

- including motivation, learning, attitude, personality, small groups, social class, demographic factors, and culture, to analyze their effects on purchasing behavior. 1 unit.
416. **Consumer Information Processing.** Analysis of information flows between buyer and seller; informational properties of demand stimulation strategies are considered from the viewpoints of the firm, consumer, and society; consumer decision making is examined drawing upon the psychology and sociology of buyer motivation and social influence. Prerequisite: Business Administration 415. 1 unit.
421. **Marketing Strategy: Theoretical Foundations.** A formal analysis of strategy drawing on concepts from the theory of games, decision theory, value theory, and information theory. Topics covered are elements of game models, classes of decision problems, games against nature, modern utility theory, information theory, group decision making, statistical decision theory, and linear and nonlinear optimization. 1 unit.
422. **Marketing Strategy: Decision Models.** The role of models in the design, implementation, and adjustment of seller strategy; application of simulation, programming, and other methods to the specification and solution of product price, promotion, and other marketing problems. Topics covered include the nature of models and model building, forecasting models, optimization models, and other decision models. Prerequisite: Business Administration 421. 1 unit.
444. **Problems in Business Policy.** Advanced problems in policy evaluation, determination, execution, administration, and control. Policy objectives in integration of product, marketing, manufacturing, finance, and organization. Prerequisite: Consent of instructor. 1 unit.
448. **Problems of Personnel Management.** Same as Labor and Industrial Relations 448. An examination of the organization and administration of the personnel function in management. This course deals with the relations of personnel administration to operating departments, and the scope of business and industrial personnel services. Analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, is carried out through case studies and direct industrial contracts. Specific consideration is given to problems up to and including placing the person in a job. Prerequisite: Business Administration 248 or equivalent; consent of instructor. 1 unit.
449. **Problems of Personnel Management.** Same as Labor and Industrial Relations 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. Prerequisite: Business Administration 448 or equivalent. 1 unit.
471. **Survey Methods in Marketing Research.** Same as Sociology 474. An analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Economics 171 or equivalent. 1 unit.
472. **Multivariate Methods in Marketing.** The use of multivariate statistical methods in marketing research. Topics covered include multiple regression and correlation, analysis of variance and covariance, canonical correlation, discriminant analysis, factor analysis, and simultaneous methods such as two-stage least squares and limited information one-maximum likelihood. Prerequisite: Economics 470. 1 unit.
473. **Experimental Design.** Training in the design, execution, and interpretation of field and laboratory experimental research. Emphasis is placed on the evaluation of alternative designs, execution of problems, and interpretation of data; a review of illustrative research studies is made, an actual study is designed, and data is collected and interpreted. 1 unit.
474. **Operations Research.** A study of quantitative techniques useful in economic analysis and decision making. Mathematical programming, dynamic programming, queueing theory, renewal theory, and simulation methods are applied to economic control systems with special emphasis on the problems of the firm. Offered in 1973-1974 and in alternate

years. Prerequisite: Mathematics 363 and Business Administration 374 or equivalent. 1 unit. SHUPP.

485. **The Sampling of Human Population and Social Organizations.** Same as Sociology 485 and Psychology 485. This course covers procedures for selecting samples from and estimating population parameters for human populations and social organizations. The types of sample designs treated include simple random samples, stratified, and cluster samples together with random number and systematic selection techniques. Emphasis is given to the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.
490. **Seminar in Business Administration.** A special topics course in the general area of business. Topics are selected by the instructor at the beginning of each semester. 1 unit.
491. **Seminar in Special Topics.** For lectures in topics of current interest not covered by regular course offerings. Subject will be announced in the Time Table. Prerequisite: Consent of instructor or head of department. 1/4 to 1 unit.
493. **Research in Special Fields.** 1/4 to 2 units.
499. **Thesis Research.** Thesis or independent study. 0 to 4 units.
500. **Economic Analysis of the Firm.** Introduces the student with little or no background in economics to basic principles of analyzing the industrial structure and developing the marketing, financial, and general operating strategies of the firm in a dynamic economic system. Graduate credit may not be received for Business Administration 500 and Economics 300 or 400. 1 unit.
501. **The Economic Environment.** Analysis of the functioning of the economy from an aggregative point of view; role of government policy in affecting the economic environment. Graduate credit may not be received for Business Administration 501 and Economics 301 or 401. 1 unit.
511. **Organizational Behavior.** An examination and analysis of the organization as a social system, and the impact of its various components on work attitudes and behavior. Topics include the development of organizational structures, organizational effectiveness, decision making and policy formulation, leadership, and change. Prerequisite: Business Administration 408. 1 unit.
512. **Business Organization and Its Environment.** An analysis of business organizations adapting to shifts in internal and external elements. Major emphasis is on (1) the business firm as a part of a complex socio-economic system; (2) the effects of government, labor unions, and political, religious, and business organizations on the executive's decision problems; (3) environmental factors conducive to organizational change; and (4) organizational growth. Prerequisite: Business Administration 511. 1 unit.
513. **Seminar in Organization Theory.** This course examines the major types of organization theory. Use of organization theory to guide research and to make business decisions; examination of major research methods used to study business organizations. Prerequisite: Business Administration 512. 3/4 unit.
520. **Marketing.** An introductory analysis of the marketing system, its operations, and the mechanisms for coordinating these operations. The relationships of the firm to other firms and other institutions in the marketing system are studied, and the effects that such relationships have on the nature of decision problems of the individual business are analyzed. The firm's problems in developing an integrated marketing program, and the specific problem areas of price, channel, location, sales, and market development are discussed. 1 unit.
522. **Quantitative Analysis for Marketing Decisions.** The development of analytic quantitative models of various aspects of the firm's marketing environment and of models of marketing decision problems is studied. The course also involves a study of the ways in which such models can be used as a basis for making marketing decisions. Topics include market measurement, estimation of various kinds of market data, identification of the

relationships between marketing variables and forecasting. Prerequisite: Business Administration 520 or equivalent. 1 unit.

524. **Market Development.** Communication from manufacturers and middlemen to consumer and industrial users, and from manufacturers to middlemen, is an essential element in the marketing process. The course deals with management of the several components of the market communication function including personal selling, advertising, sales promotion, and some marketing aspects of public relations activities for both consumer and industrial goods. Management of the market communication function is studied through cases dealing with (1) determining market communications goals and policies; (2) creating an organization to perform the market communication function; (3) planning market communication operations, including problems such as planning a sales campaign, selecting advertising media, setting standards and coordinating advertising with personal selling, and dealer promotions; (4) stimulating personnel and controlling execution of the plans; and (5) evaluating results obtained from specific selling activities. Prerequisite: Business Administration 522 or equivalent. 1 unit.
525. **Product Management.** This course deals with the decisions on the firm's total market offer, including such topics as (1) use of market analysis in making decisions on assortment, product development, pricing, packaging, branding, and sales forecasting, and (2) coordination of these decisions and actions with market communications, physical movement, production, finance, and the overall goals and policies of the firm. The use of analytic and research methods in making assortment and product decisions is emphasized. Prerequisite: Business Administration 322 or equivalent. 1 unit.
531. **Introduction to Production.** An introductory course in decision-making problems in production. The course includes the theoretical foundations for production management as well as the applications of decision-making techniques to production problems in the firm. In particular, production processes, plant layout, maintenance, scheduling, quality control, and production control are considered. 1 unit.
532. **Production Planning and Control.** Decision-making topics in production at the factory manager level and above are treated in depth. Topics include the development of generalized decision rules and systems analysis in production. In particular, the design of production control, quality control, and inventory control systems are stressed, and each of these systems is integrated into the firm as a whole. Prerequisite: First year of the M.B.A. program. 1 unit.
533. **Quantitative Techniques in Production.** An advanced course in the application of quantitative techniques to decision-making problems dealing with production in the firm. Topics include structural estimation of production systems, application of operations research techniques to production problems, and computer simulation of decision systems. Prerequisite: Business Administration 532 or equivalent. 1 unit.
540. **Written Analysis, I.** To develop the student's ability in writing reports based upon analysis of cases and the conclusions reached, this course has a threefold objective: (1) to improve the student's capacity to express himself effectively and efficiently in writing; (2) to contribute to the sharpening of his analytic skills; and (3) to help him integrate the knowledge learned in the functional fields. Prerequisite: Enrollment in a graduate program. 1/2 unit.
541. **Written Analysis, II.** The first part of this course is devoted to the scientific method of inquiry and specific research techniques. The purpose is to study both elements of basic logic and research procedures in order to help the student evaluate the reliability of data and validity of conclusions contained in business reports. The second part of the course is devoted to a major field study. Each student develops a solution to a business problem and presents an oral and written report of the solution to both the faculty and the businessmen concerned. Prerequisite: Business Administration 540 or equivalent. 1/2 unit.
542. **Business and Society.** The position of the business enterprise as an institution in American society; the role of the businessman in that society. Prerequisite: Completion of the first year of the M.B.A. program or equivalent. 1 unit.

- 543. The Law and Business Policy.** The legal environment in which business decisions are made, including the legal system and the role of courts; government taxation and regulation of business; administrative law; antitrust law; labor law; and trends in the law affecting business policy. 1 unit.
- 544. Business Policy and Planning.** Policy construction and planning of policy implementation at the executive level. Case studies of company-wide situations from the management point of view. Integration and application of material from previous courses. Credit is not given for both Business Administration 544 and 389. Prerequisite: Business Administration 408, 520, 531, 551, or equivalent. 1 unit.
- 545. Business Logistics.** Movement, distribution, and control of raw materials and finished goods; site selection for manufacturing, warehousing, and distribution facilities; transportation media, selection, inventory control, communications networks, and requirements for logistics control data. Emphasis is on developing an integrated logistics system for a company. Prerequisite: Enrollment in second year of the M.B.A. program or consent of instructor. 1 unit.
- 551. Financial Management.** An introduction to financial decision-making in the firm. This course develops a decision-making framework for determining the most efficient allocation of resources within the firm. Primary emphasis is placed on the analysis of capital investment projects, long-term sources of funds, and short-term financing problems. 1 unit.
- 552. Financial Management and Control, I.** An analysis of the tools and techniques of capital expenditure management, with emphasis on the relation of financial forecasting and control to criteria for investment planning and asset management. The theory of investment is examined, as well as the relation of organizational structure to capital planning policy. Prerequisite: Business Administration 551. 1 unit.
- 553. Financial Management and Control, II.** An analysis of the problems confronting corporate financial management in deciding appropriate methods of financing capital expenditure commitments. A thorough analysis of the specialized literature, coupled with the use of selected case material, forms the core of the course. Prerequisite: Business Administration 552. 1 unit.
- 554. Financial Theory and Policy.** Special problems of economic analysis and their relation to the functional discipline of managerial finance; includes study of techniques for forecasting financial requirements under uncertainty, problems of income determination, the relation of long-term capital commitments to uncertain payoff vectors, internal and external capital rationing, and problems of identifying capital supply functions. Prerequisite: Business Administration 553, 573, and 576. 1 unit.
- 555. Risk Management and Control.** Same as Finance 470. An analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses, techniques for risk and loss control models for risk management decision making, and procedures for administering risk management policy relating to non-speculative (insurable) risk. Prerequisite: Business Administration 552 and 560, or equivalent, or consent of instructor. 1 unit.
- 560. Managerial Accounting and Control.** An analysis of managerial controls, the information needed for their operation, and the manner in which accounting provides that information; emphasis upon accounting as a tool of management. Problems and cases stress the type of figure information relevant to managerial decisions, and the methods of using such data. 1 unit.
- 562. Industrial Cost Control.** A study of cost accounting, with emphasis on the use of operating data by management for control purposes. Methods of material pricing, labor costs, including fringe benefits; indirect manufacturing costs, direct costing, standard costs; estimated and statistical costs; distribution costs; contribution to overhead theory; depreciation and replacement of equipment; selection of plant; decision to make or buy; relation between costs and pricing policy. Prerequisite: Business Administration 560 or equivalent. 1 unit.
- 563. Controllershship.** The controller in the business organization: his property control respon-

sibilities; internal check; internal audits; insurance; his assistance to operating management through budgeting, break-even analysis, profitability studies; his relationship with groups outside of management such as investors and government agencies; emphasis on manner in which figure function of controller is used to integrate the operations of the business enterprise. Prerequisite: Business Administration 562 or equivalent. 1 unit.

570. **Mathematical Analysis for Business Decisions.** An elementary course in calculus with applications to business and economics. Topics included are differentiations, integration, Lagrange multipliers, multivariate functions, and matrices. 1 unit.
572. **Modern and Classical Statistics for Business Decisions.** The application of classical and modern statistics for business decision making. The level of the course assumes some prior knowledge of basic statistics as well as facility with elementary calculus. Prerequisite: Business Administration 570. 1 unit.
573. **The Quantitative Analysis of Decisions.** An introduction to operations research techniques. Topics include the construction and solution of linear models under certainty, and the construction of probabilistic models, specifically queueing theory, Markov chains, and sequential decisions. Prerequisite: Business Administration 570. 1 unit.
574. **Application of Operations Research Techniques.** The application of the operations research techniques developed in Business Administration 573 to practical business problems. Most of the semester is devoted to a series of field research studies. Prior to the field studies, a review of previous work in the field is made. The role of the computer in solving operations research problems, as well as its application to the field research, is also a major consideration. Prerequisite: Business Administration 573. 1 unit.
575. **Business Simulation.** An introduction to the use of computers in solving business problems. Topics include the relation of integrated data processing systems to information flows within the firm and the development of simulation models of intrafirm decision processes. Prerequisite: Business Administration 573. 1 unit.
576. **Business Forecasting and Econometrics.** An introduction to maximum likelihood estimating techniques. Topics include the use and limitations of least squares, two-stage least squares, limited-information and full-information estimates. Problems with observational errors, multi-colinearity, and auto-correlation in time-series and cross-section structural estimation are considered. A major portion of the course is devoted to the application of the econometric techniques in business forecasting and analysis. Prerequisite: Business Administration 572. 1 unit.
577. **Economics of Decision Making.** The operational analysis of the problems of individual decisions under uncertainty that arise in the practice of management. Prerequisite: Business Administration 572. 1 unit.
578. **Stochastic Models in Management Science.** The application of Markov processes to describe, analyze, and design systems of interest in management science, including queues, inventory, production, brand loyalty, stock market, and other applications. Prerequisite: Mathematics 361 or 363, or equivalent. 1 unit.
579. **Mathematical Programming for Management Science.** Mathematical programming models (linear, integer, quadratic, nonlinear, dynamic, and combinatorial) or used to describe, analyze, and design systems such as production, transportation, scheduling, and planning. Prerequisite: Mathematics 315 or equivalent. 1 unit.
582. **International Business Operations, I.** An integration of economics and the functional areas of business focused on the problems of managing international business operations. Economic, legal, functional, and administrative problems are studied through cases and literature emphasizing financial and marketing problems. Students select one of Europe, Latin America, Africa, Middle and Near East, or South Asia and Far East, for special study and reporting. Prerequisite: Completion of first year of the M.B.A. program. 1 unit.
583. **International Business Operations, II.** Continuation of Business Administration 582. Prerequisite: Business Administration 582. 1 unit.
590. **Independent Study and Research.** Directed reading and research. 1/2 or 1 unit.
599. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

Catalan

(See Spanish, Italian, and Portuguese)

CERAMIC ENGINEERING

Head of Department: Professor A. L. FRIEDBERG

Department Office: 204 Ceramics Building

101. **Ceramic Crystal Chemistry.** Crystal structure and crystal chemistry of ceramic materials, including the structure of silicates. Geometrical crystallography and discussions of crystal character and crystal growth of ceramic materials. 3 hours.
102. **Ceramic Materials and Processes.** Characterization of ceramic raw materials and their preparation, fabrication, and processing. Prerequisite: Sophomore standing. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
205. **Phase Equilibria in Ceramic Systems.** The concepts, interpretations, and utilization of phase equilibrium diagrams in multicomponent ceramic systems at high temperatures; methods of determining equilibrium relationship; interpretation of binary, ternary, and quaternary systems emphasizing quantitative calculations, metastability, and the origin of microstructure. Lecture and discussion. Prerequisite: Registration in Chemistry 245 or consent of instructor. 3 hours.
208. **Thermal Processing.** The application of the principles involved in drying and high-temperature operations utilized in processing ceramic materials. Prerequisite: Junior standing in ceramic engineering. 3 hours.
214. **Chemistry and Technology of Glass.** Elementary consideration of the general constitution of glass, unit processes and operations in the preparation of glass, and data on the glass industry; preparation of glasses of various compositions and measurement of important glass properties. Lectures and laboratory. Prerequisite: Junior standing in ceramic engineering, chemistry, or physics. 3 hours.
216. **Rate Processes in Ceramic Engineering.** The reaction kinetics of ceramic processes. High-temperature phase transformations, sintering and grain growth, nucleation and crystal growth from melts. Mechanisms of material transport in solid and liquid systems. Lectures and laboratory. Prerequisite: Chemistry 245; junior standing in ceramic engineering. 3 hours.
221. **Pyrometry.** Principles and methods used in high-temperature measurement and introduction to process temperature control. Lecture and laboratory. Prerequisite: Junior standing; sophomore physics. 2 hours.
222. **Ceramic Coatings.** Compositions and properties of ceramic coatings as porcelain enamels, and glazes. Preparation of frits, milling, application of slips, firing processes, and development of stress and opacity in coatings are discussed. Prerequisite: Junior standing in engineering. 3 hours.
271. **Design of High-Temperature Systems.** Design for dryers, and furnaces for ceramics. Laboratories. Prerequisite: Ceramic Engineering 208; Theoretical and Applied Mechanics 221. 3 hours.
272. **Ceramic Engineering Design.** Design of special equipment for ceramic fabrication processes; factory planning and layout. Laboratories. Prerequisite: Ceramic Engineering 208 and 271; Theoretical and Applied Mechanics 221. 2 hours.
298. **Special Problem.** Special topics in ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. Prerequisite: Senior standing. 1 to 2 hours. Maximum registration is 2 hours.
299. **Senior Thesis.** Research in ceramics and ceramic engineering. Written permission from

the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. To receive credit, a thesis must be presented. Prerequisite: Senior standing; grade-point average of 4.0 or better. 1 to 5 hours. May be repeated for a maximum credit of 5 hours and a minimum credit of 3 hours.

301. **Advanced Chemistry and Technology of Glass.** This course augments in greater detail some of the subject matter of Ceramic Engineering 214, and develops additional subject matter relating to the theory of glass formation and structure, and the behavior of glass as a function of composition, structure, and heat treatment. Students taking this course gain improved qualifications for research work in the field. Prerequisite: Ceramic Engineering 214 or consent of instructor. 2 hours or 1/2 unit.
307. **Thermal and Mechanical Properties of Ceramic Materials.** Interpretations of the thermal and mechanical behavior of real ceramic materials utilizing the concepts of structure correlated with characterized microstructure. Half of the course treats the mechanism of thermal dilation, heat transport, and emission. The remainder integrates the characterization of deformation, including elastic, anelastic, plastic, and viscous behavior. Temperature dependency is stressed throughout. Prerequisite: Ceramic Engineering 216 and 331, or equivalent: Theoretical and Applied Mechanics 154 and 221. 3 hours or 3/4 unit.
309. **Whiteware Materials.** A study of the characteristics and engineering properties of multi-phase polycrystalline aggregate and vitreous complexes, including the raw material preparation, fabrication, and processing. Special emphasis is placed on the single- and multi-oxide component bodies, including the crystallographic structures of the alkaline earth titanates and the ferritic spinels as whiteware materials. Prerequisite: Ceramic Engineering 216 or equivalent. 3 hours or 3/4 unit.
310. **Refractory Technology.** A study of the engineering properties and thermochemistry of polycrystalline materials for use at elevated temperatures including processing of raw materials, the manufacture, heat treatment, quality control, and specification of refractory products. Particular emphasis is placed on oxides, silicates, carbides, borides, cermets, and refractory metals with a correlation of the properties of those materials to certain design criteria. Includes laboratory if taken for one unit of graduate credit. Prerequisite: Senior standing in engineering. 3 hours, or 3/4 or 1 unit.
311. **Ceramic X-Ray Analysis.** The use of x-ray diffraction for phase identification, for the determination of crystalline lattice parameters, and for the determination of the thermal expansion of crystalline solids are discussed. Analytical methods of indexing powder diffraction patterns are covered. The determination of precise lattice parameters by means of computer programming and high-temperature x-ray techniques are reviewed. Prerequisite: Computer Science 101 and senior standing in engineering, chemistry, or geology, or consent of the instructor. 3 hours or 3/4 unit.
320. **Advanced Porcelain Enamels.** An advanced study of the field of porcelain enamels with particular emphasis on fundamentals of bond or adherence of enamel metal systems, on opacity and mechanism of color development and measurement, and on the thermal and chemical properties of coatings on metal. Specific attention is given to coatings for use on metals at elevated temperatures. Prerequisite: Ceramic Engineering 222 or consent of instructor. 2 to 3 hours, or 1/2 to 3/4 unit.
331. **Ceramic Microscopy.** A study of the optical activity in isotropic and anisotropic media with particular emphasis on the materials and products of ceramics; the application of these principles and related topics of optical microscopy to the study of the morphology, aggregation, size, and microstructure of the products of high temperature thermochemical reactions and equilibria. Includes studies in thermal microscopy if taken for one unit of graduate credit. Prerequisite: Ceramic Engineering 205 or consent of instructor. 3 hours, or 3/4 or 1 unit.
340. **Electrical Ceramics.** The subject of dielectric crystals and their electrical properties is presented. The ferroelectric and piezoelectric properties of several crystal classes are discussed and correlated. The perovskite class of ferroelectric compounds is covered in detail. Spinel, garnet, and hexagonal type ferrimagnetic crystals and their properties are discussed. Prerequisite: Ceramic Engineering 309 or consent of instructor. 3 hours or 3/4 unit.

388. **Nuclear Ceramics.** Same as Nuclear Engineering 388. A study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor. Material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in non-fissile ceramics, nuclear carbon and graphite and non-fuel ceramic isotope utilization are discussed. Prerequisite: Chemistry 245, Physics 383, or consent of instructor. 3 hours or 1 unit.
401. **Ceramic Chemistry.** Silica, silicates, fusions, and phase relations. Prerequisite: Courses in chemistry and physics. 1 unit.
402. **Ceramics.** Chemical and physical phenomena. Prerequisite: Courses in physics and chemistry. 1 to 2 units.
405. **Glass Technology.** This course, following a brief review of unit processes and operations in glass manufacture, treats from a dominantly theoretical and research point of view selected major topics relating to the glass preparation process and the chemical, mechanical, optical, and electrical properties of glass. Prerequisite: Ceramic Engineering 301 or equivalent, or consent of instructor. 3/4 or 1 unit; for students electing the course for 1 unit, extra contact hours are arranged.
406. **Glass Technology.** This course is dominantly theoretical in approach. Following a survey of the basic theoretical ideas that have been used in the development of the glass model, student readings and reports from the classical and modern literature serve as the basis of class discussions on glass structure and behavior, with emphases on structure property correlations. Prerequisite: Ceramic Engineering 405 or consent of instructor. 3/4 or 1 unit; for students electing the course for 1 unit, extra contact hours are arranged.
409. **Whitewares.** Advanced study in the field of whitewares, including fundamental considerations of glazes and all types of ceramic bodies. Special emphasis is placed on new developments in research and processing. Considerable attention is given to the ferroelectric and ferromagnetic properties of electronic ceramics. Prerequisite: Ceramic Engineering 309; Ceramic Engineering 340 or equivalent. 1 to 1 1/2 units (includes laboratory if taken for more than 1 unit).
410. **Dielectric Properties of Ceramic Materials.** Fundamental properties of vector fields are reviewed. The reaction of insulating solids to external electric fields is considered in terms of dielectric theory. The properties of ceramic dielectrics including ferroelectrics are treated in terms of present theory. The piezoelectric properties of ferroelectric crystals and ceramics are correlated with the crystal structure, microstructure, and the ferroelectric properties. Prerequisite: Mathematics 345 and 343, or consent of instructor. 3/4 or 1 unit; for students electing the course for 1 unit, extra contact hours are arranged.
412. **Structural Physical Ceramics.** Structural chemistry and crystallization behavior of ceramic systems at elevated temperatures; nucleation, crystal growth; mineral synthesis; high-temperature reaction kinetics, including phase transformations and diffusion. 3/4 or 1 unit; for students electing the course for 1 unit, extra contact hours are arranged.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy and Mining Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces. Silicate surfaces and water adsorption are emphasized. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
418. **Physics of Strong Solids.** Characterization and interpretation of physical properties of single-phase and composite materials of high strength; covalently-bonded semiconductors; transition-metal carbides, borides and nitrides; graphite; glass; fibers; precipitation-hardened metals. Prerequisite: Any one of the following: Ceramic Engineering 307 or 421, Metallurgical Engineering 384, Chemistry 342, Physics 490, or consent of instructor. 1 unit.
421. **Refractory Materials Engineering.** The interpretation of the behavior of materials for utilization in an environment where high-temperature structural stability and control of thermal energy transport are the prime considerations. Design and material selection criteria based on thermal energy control, mechanical stress response, and structural

integrity at elevated temperature are emphasized. Prerequisite: Ceramic Engineering 310 or consent of instructor. 1 unit.

- 461. **Mineralogy of Clays.** Same as Geology 461. The composition of various types of clays; the structure and properties of the clay minerals; the origin and mode of occurrence of the clay minerals and clay materials. Prerequisite: Geology 336 or Chemistry 328, or equivalent; consent of instructor. 1 unit.
- 462. **Mineralogy of Clays.** Same as Geology 462. The properties of clay materials, their relation to the structure of the clay minerals, methods of determination and control; the utilization of clays in various arts and industries. Prerequisite: Geology 461. 1 unit.
- 495. **Materials and Special Problems.** Conference and laboratory. 0 to 2 units.
- 498. **Seminar in Ceramics.** Lectures on current ceramic research and development. Presentations by visiting lecturers as well as graduate students and staff in the department. Registration required of all graduate students in ceramic engineering. Graduate students nearing completion of their theses are required to make a seminar presentation. Prerequisite: Graduate standing in ceramic engineering. 0 credit.
- 499. **Thesis Research.** Research in any of the branches of ceramics. 0 to 4 units.

CHEMICAL SCIENCES

(Including Biochemistry, Chemical Engineering, and Chemistry)

Director of School of Chemical Sciences: Professor H. S. GUTOWSKY

School Office: 106 Noyes Laboratory

Biochemistry

Head of Department: Professor L. P. HAGER

Department Office: 415 East Chemistry Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Biochemistry is an advanced interdisciplinary science requiring training in chemistry and life sciences. Therefore, students planning a major in biochemistry take an initial course program similar to the chemistry curriculum or honors biology sequence. Such beginning training assures adequate prerequisites to meet the advanced course work requirements of biochemistry major and associated minor(s).

Major: Twenty hours of advanced course work in biochemistry and chemistry, including Biochemistry 350 and 355, organic chemistry through Chemistry 336, and one year of physical chemistry (Chemistry 342 and 344, or, alternately, Chemistry 340 and 346, or Chemistry 340 and Biochemistry 351). Advanced course work excludes courses numbered 199, and 100 through 130.

Minors: Twenty or more hours chosen from physics, mathematics, or life sciences so as to include at least two 300-level courses in life sciences courses.

Departmental Distinction: Students in biochemistry registered in Biochemistry 290 (Thesis) become candidates for graduation with departmental distinction.

199. **Undergraduate Open Seminar.** 0 to 9 hours.

290. **Thesis.** Limited in general to seniors in biochemistry and chemistry. Each student who desires to do thesis research must receive written permission from a member of the biochemistry faculty. Accordingly, prospective students are encouraged to contact the biochemistry staff in the semester prior to registration in this course. Students must present a thesis to receive credit in this course. Registration of 10 hours over two semesters is expected. Prerequisite: Biochemistry 350 and 355. 4 to 6 hours.

- 350. General Biochemistry.** The chemistry and reactions of constituents of living matter, including carbohydrates, lipids, proteins, nucleic acids, vitamins, coenzymes, and minerals; the chemistry and regulation of the reactions and processes of whole organisms, plant and animal, of organs, cells, and subcellular particles and soluble components. Lectures and assigned readings. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent. 3 hours or 3/4 unit.
- 351. Physicochemical Basis of Biochemistry.** An introduction to the physicochemical methods and ideas underlying biochemistry. Prerequisite: Chemistry 340 or equivalent course at the undergraduate level, or consent of instructor. 3 hours or 3/4 unit.
- 354. Introduction to Biochemistry.** Structure and function of living matter, with emphasis on the mammalian organism. This course is designed primarily to meet the needs of veterinary medicine, nutrition, dietetics, and other professional students. Open to other students only by special permission when space is available. Prerequisite: Chemistry 131 or 136, or equivalent; laboratory course in general biology, botany or zoology; or consent of instructor. 3 hours or 3/4 unit.
- 355. Biochemistry Laboratory.** To accompany Biochemistry 350. Required of all students who expect to take advanced courses in biochemistry. An introduction to experimentation with biochemical systems, processes, and compounds of biochemical importance; identification and quantitative measurement of constituents and transformations in biological systems. Laboratory, quizzes, and assigned readings. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent; registration in Biochemistry 350. 4 hours or 1 unit.
- 356. Introduction to Biochemistry Laboratory.** To accompany Biochemistry 354. Prerequisite: Chemistry 131 or 136, or equivalent; laboratory courses in general biology, botany, or zoology; or consent of instructor. 2 hours or 1/2 unit.
- 440. Research Topics in Biochemistry.** Same as Chemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications. Topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
- 450. Chemistry of Biological Processes.** A consideration at the molecular level of biological processes including bioenergetics, biosynthetic and degradative pathways of cellular components, metabolic regulation and enzyme reaction mechanisms. Prerequisite: Biochemistry 350 and 355. 1 unit.
- 452. Experimental Techniques in Biochemistry.** Experiments on the isolation, purification, and analysis of biological material, including proteins and enzymes. Methods of studying constituents of biological material; their degradation products, and the metabolic processes, including the isolation and characterization of intermediates. Prerequisite: Biochemistry 350 and 355. 3/4 or 1 unit.
- 455. Biochemistry.** Seminar. Discussions of current research and literature. Required of all graduate students whose major is biochemistry. Prerequisite: Biochemistry 350 and 355, or equivalent. 1/2 unit.
- 490. Special Topics in Biochemistry.** This course is designed for students majoring or minor-ing in biochemistry who wish to undertake individual studies of a non-Ph.D. thesis nature, under the direction of a faculty member of the department. Prerequisite: Consent of head of department. 1/4 to 4 units (summer session, 1/4 to 2 units).
- 494. Chemical Basis of Biological Specificity.** Same as Chemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; metabolic interrelations of these molecules. 3/4 unit. Prerequisite: Chemistry 344 and 346 and Biochemistry 350 or 450; Microbiology 330; or consent of instructor.

499. **Thesis Research.** 0 to 4 units. CLARK, CONRAD, DUS, GORSKI, GUMPORT, GUNSALUS, HAGER, LEONARD, MCCLURE, NYSTROM, ROBINSON, SCHMIDT, SWITZER, TEIPEL, UHLENBECK, WEBER, WETMUR, WOOD.

Chemical Engineering

Head of Department: Professor J. W. WESTWATER

Department Office: 114 East Chemistry Building

REQUIREMENTS FOR I.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Students wishing to specialize in chemical engineering are directed to follow the special curriculum within the School of Chemical Sciences which leads to the degree of Bachelor of Science in Chemical Engineering. The requirements for this program are described in detail in the section on the specialized curricula in the College of Liberal Arts and Sciences section of the Undergraduate Study Catalog.

The chemical engineering curriculum is designed to offer undergraduate students a fundamental basis in chemistry, mathematics, and physics, along with training in the application of science to engineering problems. In addition to the required courses in chemical engineering, chemistry, physics, and mathematics, there are sufficient elective courses in other technical and nontechnical areas to provide an excellent scientific and engineering background, coupled with a flexibility which permits the program to be shaped to fit individual interests.

Departmental Distinction: Students in chemical engineering registered in Chemical Engineering 290 (Thesis) or 379 (Projects) become candidates for departmental distinction. All students are eligible for College Honors who have a 4.25 average or better. The level of distinction to be recommended is determined by the quality of the special work done, in addition to the requirements that the overall grade-point averages (for work done at the University of Illinois, exclusive of military training and physical education) of 4.20, 4.40, and 4.60 are required for the citations of Distinction, High Distinction, and Highest Distinction, respectively. Recommendation is made to the dean of the college by the head of the department.

Restrictions: Students in the chemical engineering curriculum must have a general grade-point average of at least 3.5 (exclusive of physical education or basic R.O.T.C. courses) to enter courses in the School of Chemical Sciences at the junior or senior level. A transfer student, to be accepted, must have a corresponding record in the institution or institutions from which he transfers, and he must maintain a 3.5 average for his course work at the University of Illinois. Entering freshmen or transfer students without adequate preparation in chemistry, mathematics, physics, and language may find it difficult to complete the curriculum in chemical engineering in four years.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
261. **Introduction to Chemical Engineering.** Lectures and problems on material balances and energy balances; introduction to equilibrium staged processes. Prerequisite: Chemistry 102 or 108. 3 hours.
290. **Thesis.** Limited in general to seniors in the curriculum in chemical engineering. Any others must have the consent of the head of the department. Each student taking the course must register in a minimum of five hours either in one semester or divided over two semesters. A maximum registration of ten hours in two semesters is permitted. However, Chemical Engineering 379 (two hours) may be substituted for two of the five hours required in Chemical Engineering 290. In order to receive credit, a thesis must be presented by each student registered in Chemical Engineering 290. 2 to 6 hours.
368. **Selected Topics in Chemical Engineering.** Study of selected topics in chemical engineering. The content of the course varies from semester to semester. Typical topics are optimization, chemical kinetics, phase equilibrium, biochemical engineering, kinetic theory and transport properties, etc. Prerequisite: Senior standing in chemical engineering or consent of instructor. 2 or 3 hours, or 3/4 or 1 unit. May be repeated for credit.

- 370. Chemical Engineering Thermodynamics.** The fundamental concepts and laws of thermodynamics, with emphasis on application to chemical engineering problems. Introduction to phase equilibria. Prerequisite: Chemical Engineering 261. 3 hours or 1/2 unit.
- 371. Fluid Mechanics and Heat Transfer.** Introduction to fluid statics and dynamics. Dimensional analysis. Design of flow systems. Introduction to heat transfer—conduction, convection and radiation. Prerequisite: Chemical Engineering 261 or consent of instructor. 4 hours or 1 unit.
- 373. Mass Transfer Operations.** Introduction to the theory of mass transfer. Design of separation processes; application to multicomponent systems. Prerequisite: Chemical Engineering 371 or consent of instructor. 3 hours or 3/4 unit.
- 374. Chemical Engineering Laboratory.** Experiments and computation in fluid mechanics, heat transfer, reaction kinetics, and separation processes. Prerequisite: Credit or registration in Chemical Engineering 373. 3 hours or 1/2 unit.
- 377. Dynamics and Control of Chemical Systems.** Theory and experiments covering introductory topics in process dynamics and control with special emphasis on chemical systems, including mathematical modeling, system dynamics, feedback control, computer control, and analog simulation. Prerequisite: Chemical Engineering 371; Mathematics 345; Computer Science 101. 3 hours or 3/4 unit.
- 379. Chemical Engineering Projects.** Laboratory. Development of an individual project. Prerequisite: Senior standing in chemistry or chemical engineering. 2 hours or 1/2 unit.
- 380. Heat, Mass, and Momentum Transport.** A unifying treatment of physical rate processes with particular emphasis on the formulation and solution of typical boundary value problems associated with heat, mass, and momentum transport. Prerequisite: Chemical Engineering 371 or consent of instructor; Mathematics 343 or 345. 3 hours or 3/4 unit.
- 381. Chemical Reaction Engineering.** Chemical kinetics, chemical reactor design, and the interrelationship of transport and chemical reaction in open and closed systems. Prerequisite: Chemical Engineering 373. 2 hours or 1/2 unit.
- 382. The Prediction of Physical Properties.** The prediction of equilibrium and transport properties in gases, liquids, and solids. Prerequisite: One year of physical chemistry. 2 hours or 1/2 unit.
- 384. Process Design.** A comprehensive design problem. Prerequisite: Credit or registration in Chemical Engineering 381. 1 hour or 1/4 unit.
- 464. Transport Phenomena.** Analysis of the various phenomena associated with transport processes; mechanism and phenomenological description; equations of change; interphase transport. Application to systems involving the transfer of energy, mass, and momentum. Prerequisite: Mathematics 345 or 343; Chemical Engineering 373 or consent of instructor 1 unit.
- 465. Chemical Engineering.** Seminar. Required of all graduate students whose major is chemical engineering. Prerequisite: Chemical Engineering 373. 1/4 unit.
- 466. Applied Mathematics in Chemical Engineering.** The development of mathematical models and a survey of modern mathematical methods currently used in the solution of chemical engineering problems. Topics include the application of vectors and matrices, partial differential equations, numerical analysis, and methods of optimization in chemical engineering. Prerequisite: Consent of instructor 3/4 or 1 unit.
- 468. Properties of Fluids.** The kinetic theory of gases and the prediction of transport coefficients; statistical mechanics applied to dense gases and liquids; theories of solutions. Prerequisite: A background in modern physical chemistry and physics; consent of instructor. 3/4 or 1 unit.
- 469. Special Topics in Chemical Engineering.** Various advanced topics are covered from time to time. These are generally taken during the second year of graduate study. Typical topics include turbulence, hydrodynamic instability, process dynamics, interfacial phenomena, reactor design, properties of matter at high pressure, phase transitions. Prerequisite: Chemical Engineering 464. 3/4 or 1 unit. This course may be repeated for credit.

487. **Fluid Dynamics.** Basic concepts in fluid dynamics with special emphasis on topics of interest to chemical engineers. Derivation of the Navier-Stokes equations; solutions for creeping flow, for perfect fluids, and for boundary layers; non-Newtonian fluids; turbulence. Prerequisite: Chemical Engineering 464. 1 unit.
488. **Advanced Topics in Heat and Mass Transfer.** Principles of transfer operations developed in terms of physical rate processes. Boundary layer heat and mass transfer, eddy diffusion, phase changes, and separation processes. Prerequisite: Chemical Engineering 464 or consent of instructor. 3/4 or 1 unit.
499. **Thesis Research.** Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in another department must receive permission from the head of the Department of Chemical Engineering to register in this course. 0 to 4 units. ALKIRE, DRICKAMER, ECKERT, HANRATTY, HUDSON, KOZINSKI, SANI, SCHMITZ, WESTWATER.

Chemistry

Head of Department: Professor H. S. GUTOWSKY

Department Office: 106 Noyes Laboratory

REQUIREMENTS FOR I.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Students desiring to specialize in chemistry have available two alternatives: (1) the chemistry curriculum and (2) the chemistry major in the sciences and letters curriculum.

The chemistry curriculum is a specialized program intended for those planning a career in chemistry and is limited in the junior and senior years to students with a college cumulative grade-point average of 3.5 or better. The requirements are described in detail in the section on the specialized curricula in the College of Liberal Arts and Sciences section of the Undergraduate Study Catalog.

The chemistry major in the sciences and letters curriculum ordinarily parallels other college curricula. It can be used by a student planning a career in chemistry or by a student wishing to obtain a background in chemistry for use in a related field. It is generally more desirable for a student changing his major to chemistry sometime after beginning his college work. A chemistry major planning a career in chemistry is advised to take most of the courses in chemistry, mathematics, and physics required in the chemistry curriculum.

Major: Not less than twenty hours in chemistry and biochemistry, excluding chemistry courses numbered 100 through 110 and Chemistry 199. There must be included Chemistry 340 or 342 and two other 300-level courses, at least one of them outside physical chemistry.

Minors: Twenty hours in one or two subjects from the physical sciences, the biological sciences, or mathematics, with at least eight hours in each if two are chosen. With the written approval of the departmental adviser, other subjects may be substituted.

Departmental Distinction: Students in chemistry registered in Chemistry 290 (Thesis) or Biochemistry 290 (Thesis) become candidates for departmental distinction. (All students are eligible for College Honors who have a 4.25 average or better.) The level of distinction to be recommended is determined by the quality of the special work done in addition to the requirement that the overall grade-point averages (exclusive of military training and physical education) of 4.0, 4.25, and 4.5 are required for the citations of Distinction, High Distinction, and Highest Distinction, respectively. Recommendation is made to the dean of the college by the head of the department.

SEQUENCE OF COURSES

Students in the curriculum in chemistry, majors in chemistry, and all others who desire a thorough training in the fundamentals of chemistry and their applications to modern life should select courses from the following, usually in the sequence given: Chemistry 107, 108,

136 and 181, 336, 342 and 383, 344 and 385, 315, and courses in biochemistry, chemical engineering, analytical, inorganic, organic, and physical chemistry. Students who do not meet the requirements of previous high school chemistry and the thorough mathematics background necessary for registration in Chemistry 107 should register in Chemistry 101 before taking the sequence Chemistry 102, 122, 131, 134, and 336. Students in the College of Engineering (except ceramists, ceramic engineers, and those who wish to take Chemistry 342) should register in Chemistry 101, 102, and 122.

Students who wish to satisfy a limited chemistry requirement may register for the sequence Chemistry 101, 102, 122, or 131 and 134.

RESTRICTIONS

Students in the curricula of chemistry must have at least a 3.5 general average, exclusive of the basic courses in military training and the required work in physical education, in order to be accepted by the department as juniors or seniors. A transfer student to be accepted must have a corresponding record in the institution or institutions from which he transfers and must maintain a similar average at the University of Illinois.

100. **Introductory Chemistry.** Lectures and recitations. For students not prepared to enroll in Chemistry 101 or 107. No previous credit in high school chemistry is presumed. Prerequisite: Two and one-half units in high school mathematics, or credit or registration in Mathematics 111 or 112. 2 hours.
101. **General Chemistry.** Lectures, recitations, and laboratory. For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry and energetics in chemical systems. Students may not receive credit for both Chemistry 101 and 107. Prerequisite: Credit in or exemption from Mathematics 111 or 112. 4 hours.
102. **General Chemistry.** Lectures, recitations, and laboratory. Applications of principles to typical chemical systems: equilibria, transition elements, nonmetals, organic and biochemical systems. Students may not receive credit for both Chemistry 102 and 108. Prerequisite: Chemistry 101 or 107, or advanced placement credit for one semester of college-level chemistry. 4 hours.
107. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Students may not receive credit for both Chemistry 107 and 101. Credit toward graduation is received in Chemistry 107 only if Chemistry 109 is also completed. Prerequisite: One year of high school chemistry with at least a "B" average grade; credit or registration in Mathematics 120; registration in Chemistry 109. 3 hours.
108. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Credit toward graduation is received in Chemistry 108 only if Chemistry 110 is also completed. Students may not receive credit for both Chemistry 108 and 102. Prerequisite: Chemistry 107 and/or 109; registration in Chemistry 110. 3 hours.
109. **General Chemistry Laboratory.** Laboratory and discussions. To be taken with Chemistry 107. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without registration in Chemistry 107. 2 hours. Students with credit in Chemistry 101 may take Chemistry 109 for a maximum of 1 hour of credit.
110. **General Chemistry Laboratory.** Laboratory and discussions. To be taken with Chemistry 108. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without registration in Chemistry 108. 2 hours. Students with credit in Chemistry 102 may take Chemistry 110 for a maximum of 1 hour of credit.
122. **Elementary Quantitative Analysis.** Gravimetric and volumetric analysis, stoichiometrical relations, practical applications. For all students in home economics and premedical courses and all others who have not followed the sequence Chemistry 107 and 108. Prerequisite: Chemistry 102. 5 hours.

131. **Elementary Organic Chemistry.** Basic structural and synthetic organic chemistry is presented with emphasis on applications of this material to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Equivalent to the lecture portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 131 and Chemistry 136. Prerequisite: Chemistry 102, or 108. 3 hours.
134. **Elementary Organic Chemistry Laboratory.** Basic laboratory technique in organic chemistry is presented with emphasis on experiments of interest to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Equivalent to the laboratory portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 134 and 181. Prerequisite: Credit or registration in Chemistry 131. 2 hours.
136. **Basic Organic Chemistry.** Fundamental structural, synthetic, and mechanistic organic chemistry is presented. The course is for students whose major is chemistry or for those registering in the curriculum in chemistry or chemical engineering. Chemistry 181 is to be taken concurrently. Students may not receive credit for both Chemistry 136 and 131. Prerequisite: Chemistry 108 or 122; Mathematics 130, 131, or 135. 3 hours.
181. **Structures and Synthesis.** A laboratory course emphasizing molecular structure and synthetic chemistry. Prerequisite: Chemistry 108 or 122; Mathematics 130, 131, or 135; credit or registration in Chemistry 136. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
245. **Physical Chemistry for Engineers.** Primarily for ceramists, metallurgists, and other engineering students. Not offered to chemistry or chemical engineering majors. Provides the elements of chemical thermodynamics and chemical kinetics, and provides an introduction to the statistical concepts of entropy. Prerequisite: Chemistry 102; Physics 107 or 108; Mathematics 140, 141, or equivalent. 3 hours.
290. **Thesis.** Research, with thesis, under the direction of a senior staff member in chemistry. Normally the student takes two semesters of Chemistry 290 in his senior year. The course is recommended for all those who plan to do research and graduate study, and it or Biochemistry 290 is a prerequisite for graduation with distinction in chemistry. In the semester preceding their initial enrollment, those interested in taking the course should consult with their advisers and with the graduate adviser for the area of interest in which they plan to work. A maximum of ten hours may be counted toward graduation and a thesis must be presented for credit to be received. 2 to 6 hours.
315. **Inorganic Chemistry.** Nuclear and extra-nuclear atomic structures and their relation to the properties of the elements and their compounds; types of bonding; survey of the periodic relationships; preparation and applications of the elements and their compounds. Prerequisite: Credit or registration in physical chemistry. 3 hours or 3/4 unit.
316. **Inorganic Chemistry Laboratory.** Preparation of typical inorganic compounds illustrating special and advanced techniques, including characterization by modern physical methods. Prerequisite: Chemistry 383, or credit or registration in Chemistry 315, or equivalent. 3 hours or 3/4 unit.
321. **Instrumental Analysis.** Advanced instrumental methods of chemical analysis and their application to the study of chemical reactions. Prerequisite: Chemistry 340 or 342; Chemistry 383. 3 hours or 3/4 unit.
322. **Separation Methods and Quantitative Organic Analysis.** Theory and practice of gas, liquid, ion-exchange, and gel permeation chromatography, countercurrent distribution, electrophoresis, and distillation; qualitative and quantitative interpretation of IR, mass, and NMR spectroscopy; quantitative methods of organic analysis via functional groups. Prerequisite: Chemistry 336. 4 hours or 1 unit.
323. **Applied Electronics for Scientists.** A lecture and laboratory course designed expressly for chemists and other scientists or engineers who have little or no background in electronics, but who need a working knowledge of electronic devices, circuits, and instruments. The course begins with electronic principles and leads systematically into

digital, analog, and servo systems used in scientific instrumentation. Prerequisite: Senior or graduate standing in any of the physical sciences or engineering, or consent of instructor. 4 hours or 1 unit.

- 336. Organic Chemistry.** Second course. Lectures and recitations. Prerequisite: Chemistry 131 and 134 or Chemistry 136 and 181. 3 hours or 3/4 unit.
- 337. Organic Chemistry.** Laboratory experiments in organic chemistry with emphasis on synthesis. Prerequisite; Credit or registration in Chemistry 336. 3 hours or 3/4 unit.
- 338. Separation, Purification, and Identification of Organic Compounds.** Separation, purification, and identification of organic compounds using modern research methods; the identification of organic compounds by the use of spectroscopic methods and chemical conversion; the separation of mixtures and the purification of the components by crystallizations, sublimation, distillation, extraction, and chromatography. The qualitative and quantitative identification of the components of a mixture. Prerequisite: Chemistry 336 and 337. 4 hours or 1 unit.
- 339. Theoretical Organic Chemistry.** Theoretical interpretation of reactivity, reaction mechanisms, and the nature of common reaction intermediates; carbonium ions, free radicals, and carbanions. Prerequisites: Chemistry 338 or consent of instructor. 3 hours or 3/4 unit.
- 340. Principles of Physical Chemistry.** A one-semester course in physical chemistry emphasizing topics most important to students in the biological and agricultural sciences. Not open to students in the specialized curricula in chemistry and chemical engineering. Prerequisite: Chemistry 122 and 131, or equivalent; Physics 102; Mathematics 130 or equivalent. 4 hours or 1 unit.
- 341. Elementary Physical Chemistry Laboratory.** A laboratory course to accompany Chemistry 340. Prerequisite: Registration in Chemistry 340 or credit for one semester of a lecture course in physical chemistry. 1 hour or 1/4 unit.
- 342. Physical Chemistry.** This course and Chemistry 344 constitute a year-long study of chemical principles, covering topics such as atomic and molecular structure, properties and thermodynamics of gases, liquids, crystals, phase equilibria, solutions, surface chemistry, chemical equilibrium, electrochemistry, chemical thermodynamics, and chemical kinetics. Students should not enroll in Chemistry 342 who do not intend to take Chemistry 344. Prerequisite: Chemistry 108, 122, 123, or equivalent; Physics 106, 107, and 108, or two semesters of general physics with concurrent registration in the third semester; credit or registration in Mathematics 140 or equivalent. 3 hours or 3/4 unit.
- 344. Physical Chemistry.** Continuation of Chemistry 342. Prerequisite: Chemistry 342. 3 hours or 3/4 unit.
- 346. Physical Chemistry of Macromolecules.** The physical properties of systems containing large molecules, with special emphasis on proteins, nucleic acids, and high polymers; the use of physical methods for the characterization of such substances. Prerequisite: Chemistry 340 or 344. 3 hours or 3/4 unit.
- 348. Advanced Physical Chemistry.** The sequence Chemistry 348 and 349 is designed to give seniors and graduate students a unified treatment of physical chemistry on an advanced level. Topics discussed are the electronic structure and spectra of atoms, principles of wave mechanics, experimental and theoretical aspects of the chemical bond in diatomic and polyatomic molecules, statistical thermodynamics, and chemical kinetics. Prerequisite: Chemistry 344 or equivalent. 4 hours or 1 unit.
- 349. Advanced Physical Chemistry.** Continuation of Chemistry 348. Prerequisite: Chemistry 348. 4 hours or 1 unit.
- 383. Dynamics, Structure, and Physical Methods.** A laboratory course presenting the relationship of dynamics and structure with emphasis on the use of physical methods to follow the course of reactions. Prerequisite: Chemistry 136 and 181; credit or registration in Physics 108, Mathematics 140, and Chemistry 342. 2 hours or 1/2 unit.
- 385. Chemical Fundamentals.** A laboratory course with experiments on the fundamental physical nature of chemical phenomena. Prerequisite: Chemistry 342 and 383; credit or registration in Chemistry 344. 4 hours or 1 unit.

392. **Applied X-Rays.** Generation and detection of x-rays; absorption and scattering of x-rays by matter. Crystals; crystal and molecular symmetry. Techniques of x-ray diffraction. Identification and analyses; deduction of atomic positions. Prerequisite: Chemistry 342 or consent of instructor. 3 hours or 3/4 unit.
395. **History of Science with Particular Reference to Chemistry.** Prerequisite: Twenty hours of laboratory science. 2 hours or 1/2 unit.
396. **Atomic Physics.** Same as Physics 381. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules. The topics discussed include evidence for the atomic nature of matter, the properties of free electrons and ions, photons and their interaction with matter, atomic spectra and structure, molecular spectra and structure, and an introduction to the ideas of quantum mechanics. Students may not receive credit for Chemistry 396 and Physics 381 or 386. Prerequisite: General physics; Mathematics 343 or 345. It is recommended that chemistry majors take Chemistry 344 before registering in this course. 4 hours or 1 unit.
397. **Radiochemistry.** Same as Nuclear Engineering 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 3 hours or 3/4 unit.
398. **Radiochemistry Laboratory.** Same as Nuclear Engineering 398. To accompany Chemistry 397. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. Laboratory and discussion. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 2 hours or 1/2 unit.
402. **Inorganic Chemistry.** The less familiar elements and their relationship in the periodic system. Lectures, reports, and assigned readings. 1 unit.
404. **Advanced Inorganic Chemistry Laboratory.** Specialized laboratory techniques; more difficult inorganic syntheses. Prerequisite: Credit or registration in one of the lecture courses in inorganic chemistry in the 400 series. 1/4 to 3/4 unit.
405. **Inorganic Chemistry.** Seminar. Required of all graduate students whose major is inorganic chemistry. 1/4 unit.
406. **Physical Inorganic Chemistry.** Qualitative description of the bonding in inorganic compounds; use of physical methods to provide information about the structure and reactions of inorganic compounds; structures and reactions of inorganic compounds in solution. Prerequisite: Chemistry 315 and 344. 1 unit.
407. **Special Topics in Inorganic Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as organometallic chemistry, advanced ligand field theory and molecular orbital theory of inorganic compounds, kinetics and mechanisms of inorganic reactions, etc. Prerequisite: Chemistry 406 or consent of instructor. 1/2 to 1 unit. Students may repeat this course for credit.
408. **The Chemistry of Complex Inorganic Compounds.** The nature of the coordinate bond; applications of complex compounds. Prerequisite: Chemistry 315. 1 unit.
421. **Spectrochemical Methods of Analysis.** Emission spectroscopy; Raman spectroscopy; mass spectrometry; ultraviolet, visible, infrared, and microwave absorption spectroscopy; colorimetry, fluorimetry, interferometry, and polarimetry. Lectures and laboratory. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree 1 unit.
422. **Electrical Methods of Chemical Analysis.** Polarography, potentiometric, amperometric, conductometric titrations, and other selected topics. Lectures and laboratory. Prerequisite: Chemistry 344 or equivalent. 1 unit.
423. **Electron Microscopy.** Same as Biology 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission of electron microscopes and its modern variants, including lectures and demonstrations of modern high vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A

course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics, and consent of instructor. 1/2 unit.

424. **Quantitative Analysis.** Advanced principles, including chemical statistics, calculations, experimental methods, and applications. 1/2 unit.
425. **Analytical Chemistry.** Seminar. Required of all graduate students whose major is analytical chemistry. 1/4 unit.
427. **Applied X Rays: Crystallography.** Lectures. Prerequisite: Training in physics and physical chemistry. 3/4 unit.
429. **Electron Microscopy with Laboratory.** Same as Biology 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate sections to meet special needs of biologists, geologists, and those interested in electron diffraction. (Most theory lectures may be omitted by those enrolled or having credit in Biology or Chemistry 423.) Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics, two semesters of college mathematics, three semesters of chemistry, and consent of instructor. 1 unit.
431. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on reaction mechanisms and synthesis. Prerequisite: Chemistry 430 or 336; one year of physical chemistry. 1 unit.
432. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on structure. Prerequisite: Chemistry 431 or 336. 1 unit.
433. **Organic Chemistry.** Special topics in organic chemistry. An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as natural product synthesis and biosynthesis, organic photochemistry, chemistry of special families of organic compounds, etc. Prerequisite: Chemistry 431 and 432, one of which may be taken concurrently. 1/2 or 3/4 unit; 3/4 unit requires two lectures per week. Students may repeat this course for credit.
434. **Advanced Organic Synthesis.** Lecture and laboratory. 1/4 to 1 unit.
435. **Organic Chemistry.** Seminar. Current literature in organic chemistry. Prerequisite: Consent of instructor. 1/2 unit.
436. **Experimental Organic Chemistry.** A lecture course on research techniques in organic chemistry. Prerequisite: Consent of instructor. 1/4 unit.
440. **Research Topics in Biophysical Chemistry.** Same as Biochemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications. Topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
441. **Thermodynamics and Statistical Thermodynamics.** Fundamentals of classical thermodynamics with emphasis on equilibrium and stability criteria; an introduction to equilibrium statistical mechanics with discussion of several ensembles and applications to ideal systems of interest to chemists; introduction to non-equilibrium thermodynamics. Prerequisite: Chemistry 342 and 344, or equivalent. 1 unit.
442. **Statistical Mechanics.** Fundamentals of equilibrium statistical mechanics with selected applications to interacting classical fluids: dense gases, solutions, liquids, plasmas, ionic solutions; introduction to non-equilibrium statistical mechanics and linear response theory. Prerequisite: Chemistry 441 and 338 or equivalent, or consent of instructor. 1 unit.
443. **Quantum Dynamics.** The quantum mechanical description of time-dependent processes, including discussions of time-dependent Schrodinger equation, approximations, interaction of matter with radiation, wave packets, elastic and inelastic scattering, and

relaxation phenomena. Prerequisite: Registration in Chemistry 348 or consent of instructor. 1 unit.

445. **Physical Chemistry. Seminar.** Required of all graduate students whose major is physical chemistry. Prerequisite: Consent of instructor. 1/4 or 1/2 unit.
447. **Approximation Methods in the Quantum Mechanics of Collisions.** Designed for entering and higher graduate students. Treats several approximation methods in the quantum mechanics of collisions, principally the semi-classical method. The portions of theoretical mechanics and complex variables employed for handling semi-classical solutions are developed as needed. Elastic, inelastic, and reactive collisions are considered. Prerequisite: Consent of instructor. 1 unit.
448. **Chemical Kinetics.** Chemical reaction and theory of rate processes. Lectures. Prerequisite: Chemistry 441 or consent of instructor. 3/4 unit.
449. **Special Topics in Physical Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as molecular spectroscopy, statistical mechanics, radiation and hot-atom chemistry, molecular quantum mechanics, radiofrequency spectroscopy, advanced experimental methods, kinetics of irreversible processes and cooperative phenomena, etc. Prerequisite: Consent of instructor. 1/2 or 1 unit. Students may register for credit more than once.
490. **Special Topics in Chemistry.** This course is designed for students majoring or minoring in chemistry who wish to undertake individual studies of a non-Ph.D. thesis nature, under the direction of a faculty member of the department. Prerequisite: Consent of instructor and of head of department. Staff for the course is the same as for Chemistry 499. 1/4 to 4 units.
493. **Advanced Electron Microscopy.** Same as Biology 493. Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, the analysis and study of varied materials by use of transmission and/or scanning electron microscopes and by the techniques of electron diffraction. Open to qualified students in all departments. Prerequisite: Credit in Biology or Chemistry 429; consent of instructor. 1/4 to 1/2 unit.
494. **Chemical Basis of Biological Specificity.** Same as Biochemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; metabolic interrelations of these molecules. Prerequisite: Chemistry 344 and 346, and Biochemistry 350 or 450; Microbiology 330; or consent of instructor. 3/4 unit.
496. **The use of Carbon-14 in Labeling Techniques.** A comprehensive study of the chemistry of carbon-14. The laboratory work deals with vacuum-line manipulations and synthesis, degradation, and assay of radioactive carbon compounds. Prerequisite: Chemistry 336, 337, and 338, or equivalent; consent of instructor. 3/4 or 1 unit.
499. **Thesis Research.** A candidate for the master's degree who elects research is required to present a thesis in order to apply credit in Chemistry 499 toward meeting the requirements of the degree. A thesis is always required of students working toward the Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Work may be taken in any of a wide variety of fields, subject to the approval of an appropriate staff member who serves as the student's thesis adviser. Much of present research involves more than one of the traditional fields and student programs are planned accordingly, often on a highly individual basis. Accordingly, the following listing of fields and staff is intended to be informative, but it is not all inclusive. Details with respect to the programs possible are available from the various staff concerned and also from the Head of the Department of Chemistry. 0 to 4 units.
Analytical Chemistry. JONAS, LAITINEN, MALMSTADT, NATUSCH, RINEHART.
Biophysical Chemistry. GUNSALUS, LEONARD, PAUL, RINEHART, SCHMIDT, TIEPEL, WEBER, WETMUR, WOOD.
Inorganic Chemistry. BAREFIELD, BEATTIE, BROWN, DRAGO, HAIGHT, HENDRICKSON, STUCKY.

Organic Chemistry. APPLEQUIST, BEAK, COATES, CURTIN, FORD, KATZENELLENBOGEN, LEONARD, MARTIN, PAUL, PIRKLE, RINEHART, SMITH, SNYDER.

Physical Chemistry and Chemical Physics. BELFORD, CHANDLER, DRICKAMER, FLYGARE, GUTOWSKY, HUMMEL, JONAS, LOMBARDI, McDONALD, MARCUS, PAUL, SCHMIDT, SECREST, TIEPEL, WETMUR, YANKWICH, YARDLEY.

Radiochemistry. HUMMEL, NYSTROM.

Chinese

(See Asian Studies)

CIVIL ENGINEERING

Head of Department: Professor N. M. NEWMARK

Department Office: 1114 Civil Engineering Building

195. **Introduction to Civil Engineering.** A civil engineering orientation course including historical developments, educational requirements, relation to science, professional practice, and specialties in the profession. Prerequisite: Sophomore standing in civil engineering. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Engineering Surveying.** Introduction to surveying and photogrammetry. Prerequisite: Civil Engineering 293; credit or registration in Computer Science 101. 4 hours.
205. **Construction and Route Surveying.** Principles of construction layout and route location; data collection; horizontal and vertical alignment; earthwork. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.
214. **Properties and Behavior of Concrete.** Engineering properties of plain concrete; influence of cements, aggregates, water and mixtures on the properties of concrete; structure of gel and concrete; design of mix; behavior under various types of loading and environments; fracture, creep, and durability. Laboratory practice is an important part of the course. Prerequisite: Theoretical and Applied Mechanics 223 or 224; junior standing in engineering or architecture. 2 hours.
216. **Construction Engineering.** Introduction to the construction processes: contracting and bonding, planning and scheduling, estimating and project control, scientific productivity models, construction econometrics. Prerequisites: Civil Engineering 292; credit or registration in Computer Science 101 and Civil Engineering 293. 3 hours.
220. **Materials for Transportation Facilities.** Materials for the construction of transportation roadways, including soils, aggregates, soil-aggregates, bituminous materials, asphaltic mixtures, and stabilized soils. Properties, behavior, mixture analysis, and quality control are emphasized. Prerequisite: Credit or registration in Civil Engineering 280, or consent of instructor. 3 hours.
221. **Analysis and Design of Roadways.** Behavior, performance, and structural design of roadways for highways, airfields, railroads, and rapid transit. Additional topics are also considered: environmental factors, maintenance, and pavement economics. Prerequisite: Credit or registration in Civil Engineering 280, or consent of instructor. 3 hours.
230. **Introduction to Transportation Engineering.** Introduction to engineering principles common to all types of transportation; historical development and present systems of transport; techno-economic characteristics of airways, highways, pipelines, railroads, and waterways; coordination and integration; planning for transport use. Prerequisite: Junior standing in engineering, architecture, or urban planning, or consent of instructor. 3 hours.
231. **Introduction to Transportation Systems.** Transportation systems must be planned and designed through considering the interaction between engineering, social, economic, and

political conditions. Included in transportation system planning are concepts of forecasting traffic demand, network design, and trip distribution, and evaluation of alternative systems for that demand. Prerequisite: Civil Engineering 230 and 292, or consent of instructor. 3 hours.

240. **Control of the Urban Environment.** Discussion of the quality of the urban environment and identification of the sources and causes of deterioration of this environment. Effects of air pollution, water pollution, refuse disposal, housing and land use planning are discussed along with methods and programs for control. Prerequisite: Junior standing. 3 hours.
241. **Water Quality and Water Pollution.** Water quality and quality criteria for domestic and industrial usages; sources and types of pollution; fate of pollution and its effect on the environment; role of pollution in water resources management. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours.
242. **Sanitary Engineering Processes.** Fundamental theory underlying the unit processes and the unit operations utilized in the treatment of water for domestic and industrial usage; treatment of domestic and industrial waste waters. Prerequisite: Theoretical and Applied Mechanics 235; credit or registration in Civil Engineering 241. 3 hours.
255. **Introduction to Hydrosystems Engineering.** Introduction to design and analysis of systems directly concerned with the occurrence and flow of water. A quantitative introduction to the three basic areas of hydrology, hydraulic engineering, and water resources planning is presented. The topics are introduced in the context of a water system and emphasis is placed on their engineering significance. Prerequisite: Theoretical and Applied Mechanics 235 or equivalent; Credit or registration in Civil Engineering 292 and 293, or equivalent. 3 hours.
261. **Fundamentals of Structural Engineering.** Analysis and behavior of framed structures: idealization of structures and loadings; analysis and behavior of members; analysis of assembled structures by the displacement method including computer applications, slope-deflection, and moment distribution. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
262. **Structural Theory, II.** Energy principles in structural analysis; virtual displacements; deflections; strain energy; Castigliano's theorem; least work; applications to beams, frames, and trusses; design process, influence lines, envelopes of maximum functions. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: Civil Engineering 261. 3 hours.
263. **Behavior and Design of Metal Structures, I.** An introduction to the design of metal structures; behavior of members and their connections; theoretical, experimental, and practical bases for proportioning members. Prerequisite: Theoretical and Applied Mechanics 224 and Civil Engineering 261, or consent of instructor. 3 hours.
264. **Reinforced Concrete Design, I.** An introduction to the design of reinforced concrete structures; behavior of beams, columns, and frames; theoretical, experimental, and practical bases for proportioning members. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: Civil Engineering 214 and 261; Theoretical and Applied Mechanics 224. 3 hours.
280. **Introduction to Soil Mechanics and Foundation Engineering.** Classification of soils, compaction in the laboratory and in the field, soil exploration, boring and sampling, one-dimensional settlement analyses, strength, bearing capacity of foundations, and stability of retaining walls and slopes. Prerequisites: Theoretical and Applied Mechanics 221. 3 hours.
290. **Legal Aspects of Engineering Contracts and Specifications.** Same as General Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; business and technical clauses of specifications. Credit is not given for both Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
292. **Design and Planning of Civil Engineering Systems.** Introduction to the synthesis and

design of systems dependent upon civil engineering technology; the structuring, modeling, and simulation of such systems; the role of the decision maker and the use of optimal principles in engineering planning. Prerequisite: Integral calculus. 3 hours.

293. **Stochastic Concepts in Civil Engineering.** Identification and modeling of non-deterministic problems in civil engineering, and the treatment thereof relative to engineering design and decision-making. Development of stochastic concepts and simulation models, and their relevance to real design and decision problems in various areas of civil engineering. Prerequisite: Integral calculus. 3 hours.
295. **Professional Practice.** A series of lectures by outstanding authorities on the practice of civil engineering and its relations to economics, sociology, and other fields of human endeavor. Lectures are given approximately once a week. Prerequisite: Junior standing. 0 credit.
297. **Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by the department. Prerequisite: Senior standing. 1 to 4 hours.
306. **Adjustment of Observations.** A study of the method of least squares and its application to the adjustment of photogrammetric and geodetic problems; formation and solution of the normal equations, including the use of matrix algebra; types of adjustments for hybrid systems; discussion of the normal distribution and the statistical foundations of the method of least squares. Prerequisite: Mathematics 315 and Civil Engineering 201, or consent of instructor. 3 hours, or 3/4 or 1 unit.
307. **Photogrammetric Engineering.** A study of metrical photography in civil engineering practice, analytical and analogue photogrammetric systems, photometrics and outer space mapping techniques, and automated photographic mapping systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or 3/4 or 1 unit.
309. **Geodetic Engineering.** Geodetic positioning on a reference ellipsoid, least squares adjustment of first-order triangulation and trilateration nets using observation equations, satellite triangulation, principles and operations of modern instruments, geodetic leveling, map projections, rational design of geodetic systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or 3/4 to 1 unit.
314. **Fundamentals of Systems Approach.** Introduction to the application of linear programming, network theory, and queuing theory to the synthesis of civil engineering systems. Prerequisite: Civil Engineering 292, or consent of instructor. 3 hours, or 1/2 or 1 unit.
315. **Construction Productivity.** Introduction to the application of scientific principles to the measurement of and the forecasting of productivity in construction engineering; conceptual and mathematical formulations of the labor, equipment, and material factors affecting productivity. Prerequisite: Civil Engineering 216, or consent of instructor. 3 hours, or 1/2 or 1 unit.
316. **Construction Planning.** Introduction to the applications of scientific principles to the normative planning of construction operations. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or 1/2 or 1 unit.
318. **Construction Cost Analyses and Estimates.** Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts of and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; the fundamentals of cost recording for construction cost accounts and cost controls. Prerequisite: Civil Engineering 216, or consent of instructor. 3 hours, or 1/2 or 1 unit.
321. **Bituminous Material and Mix Design.** Properties and control testing of bituminous materials; analysis of bituminous paving mixtures; composition and design of asphaltic concrete and soil-asphalt mixes. Prerequisite: Civil Engineering 214 and 220, or consent of instructor. 2 hours or 1/2 unit.
322. **Development of Highway Facilities.** Analysis of factors in developing a highway transportation facility; traffic estimates and assignment; problems of highway geometrics and design standards; planning and location principles; intersection design factors; street systems and terminal facilities; programming improvements; drainage design; structural

- design of surface; concepts of highway management and finance; highway maintenance planning. Prerequisite: Civil Engineering 220 or consent of instructor. 4 hours or 1 unit.
325. **Highway Traffic Characteristics.** Vehicle operating characteristics, driver characteristics, pedestrian characteristics, roadway characteristics, as they are related, individually and collectively, as traffic stream characteristics, to the planning, design, and operation of highway facilities. Prerequisite: Civil Engineering 230 or consent of instructor. 3 hours or 1/2 unit.
333. **Urban and Regional Transportation.** Importance of transportation and its relation to urban and regional planning; characteristics of transport systems; transportation planning including surveys, data analysis, and problems of administration and finance; coordination and integration of transport. Prerequisite: Senior or graduate standing, or consent of instructor. 3 hours, or 1/2 or 1 unit.
334. **Airport Design.** Basic principles of site selection for airports and fundamental considerations of design, construction, and maintenance of airport pavements and structures. Prerequisite: Civil Engineering 220 and senior standing in civil engineering, or consent of instructor. 3 hours, or 1/2 or 1 unit.
335. **Railway Construction and Maintenance.** Loads and load distribution on track and subgrade; roadbed construction and stabilization; track stresses; design and materials; turnouts and crossings; maintenance programs. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or 1/2 or 1 unit.
336. **Railway Location and Operation.** Influences of traffic, alignment, distance, gradients, and motive power upon operating expenses; mechanics of train operation; economic design of location. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or 1/2 or 1 unit.
337. **Signals.** Train movements; systems of signals; track circuits; track capacity; interlockings; economics of signaling. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 2 hours, or 1/2 or 1 unit.
338. **Terminals.** Design and operation of freight terminal facilities for rail, highway, air, and water carriers; passenger terminals; special terminal requirements for specific commodity categories; coordination. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or 1/2 or 1 unit.
345. **Environmental Health Engineering.** The application of engineering principles to the control of environmental sanitation and communicable disease control, including administration, biostatistics, epidemiology, vector control, pesticides, milk, and food sanitation, swimming pools, individual water supply and waste-water disposal, plumbing, refuse collection, and disposal, industrial hygiene and air pollution, radiological health, and international health. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or 3/4 unit.
346. **Biology of Polluted Water.** The significance of biology in water quality, stream pollution, and waste treatment. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or 1/2 unit.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, General Engineering, Geography, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
349. **Nuclear Radiation Protection.** Same as Nuclear Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry, sources of ionizing radiation, determination of radiation tolerances, dosimetric instruments, and standards and regulations. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent. 4 hours or 1 unit.

350. **Hydrology.** An applied course on hydrology dealing with environmental water problems; discussing principles of hydrologic systems and their components; presenting methods of analysis and their applications to various purposes of water resources planning and development. Prerequisite: Civil Engineering 255 or equivalent with consent of instructor. 3 hours, or 3/4 or 1 unit.
351. **Hydromechanics.** Applied fluid mechanics with particular reference to topics in hydraulic design, analysis, and research in civil engineering areas, dimensional analysis and dynamic similarity, analysis of potential flow, boundary-layer problems, turbulence and diffusion, hydraulic transients, water waves, and transport phenomena. Prerequisite: Theoretical and Applied Mechanics 235, or consent of instructor. 3 hours or 3/4 unit.
352. **Water Resources Design.** Study and evaluation of phases of river mechanics, water resources history, and project implementation, and development of a water resources project plan. Prerequisite: Civil Engineering 255, or consent of instructor. 3 hours or 3/4 unit.
353. **Hydraulic Structures.** Introduction to the design of hydraulic structures, consideration of types and functions of dams; hydrologic design; hydraulic design of spillways and outlet works; determination of loads and stresses for concrete structures; seepage, piping, and stability of earth structures. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours or 3/4 unit.
356. **Hydraulics of Surface Drainage.** Application of hydraulic and hydrologic principles; elements of channel design; hydrologic determination of design flow; flow through bridge openings and other obstacles; hydraulics of drainage areas; overland flow; run-off from highways, runways, and urbanized areas; hydraulics of storm-drain systems; culvert design. Prerequisite: Civil Engineering 255, or consent of instructor. 3 hours, or 3/4 or 1 unit.
361. **Advanced Structural Analysis.** A unified development of force and displacement analysis methods for linearly elastic framed structures including introduction to matrix methods of formulation. Applications to plane and space frames and trusses; computer use. Prerequisite: Civil Engineering 262 or equivalent. 3 hours, or 3/4 or 1 unit.
363. **Behavior and Design of Metal Structures, II.** Members under combined loads; welded, riveted, and bolted connections; moment-resistant connections; plastic design. Prerequisite: Civil Engineering 263, or consent of instructor. 3 hours, or 3/4 or 1 unit.
364. **Reinforced Concrete Design, II.** Limit design of continuous reinforced concrete members and slabs of various types. Prerequisite: Civil Engineering 264; credit or registration in Civil Engineering 262. 3 hours, or 3/4 or 1 unit.
365. **Design of Structural Systems.** The whole structural design process including definition of functional requirements, selection of structural scheme, formulation of design criteria, preliminary and computer aided proportioning, analysis of response, cost, and value. Prerequisite: Civil Engineering 263 or 264, or equivalent. 3 hours or 1 unit.
366. **Behavior of Reinforced Concrete Members.** Ultimate strength and behavior of reinforced concrete members and relations between results of research and current specifications for design; members subjected to flexure, axial compression, combined flexure and axial load, combined flexure and shear, and bond. Prerequisite: For undergraduates, senior standing and Civil Engineering 264; for graduates, Bachelor of Science degree in civil engineering or architecture with courses in structures and reinforced concrete design. 4 hours or 1 unit.
368. **Prestressed Concrete.** Principles and methods of linear prestressing; behavior, strength, and design of non-composite simple beams, composite simple beams, and continuous beams; time-dependent variables and long-time deflections. Prerequisite: Civil Engineering 262 and 264. 3 hours, or 3/4 or 1 unit.
369. **Behavior and Design of Wood Structures.** Theory and practice in design of modern wood structures; the effect of the plant origin and physical structures of wood on its mechanical strength; fasteners and their significance in design and the development of design formulae. Prerequisite: Civil Engineering 261 or equivalent, or consent of instructor. 3 hours, or 3/4 or 1 unit.

374. **Introduction to Structural Dynamics.** Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; introduction to systems with distributed mass and flexibility. Credit is not given for both Civil Engineering 374 and Theoretical and Applied Mechanics 311. Prerequisite: Theoretical and Applied Mechanics 212; Mathematics 345; Civil Engineering 261, or equivalent. 3 hours, or 3/4 or 1 unit.
379. **Applied Structural Mechanics.** Study of beams under lateral load; beams with combined lateral load and thrust; buckling; beams on elastic foundations; applications of Fourier series and virtual work principles to beam-type structures; stress and strain in three dimensions; applications to flexure of beams and plates and to constrained torsion; elements of the engineering theory of plates. Prerequisite: Mathematics 345 and one undergraduate course in statically indeterminate structures, or consent of instructor. 3 hours, or 3/4 or 1 unit.
383. **Soil Mechanics and Soil Properties.** Index properties and engineering classification; water flow and hydraulic properties; stress in soil; stress-strain properties of soils; consolidation; shear strength; properties of natural soil deposits; unsaturated soils; experimental measurements. Prerequisite: Civil Engineering 280 or equivalent, or consent of instructor. 4 hours or 1 unit.
384. **Applied Soil Mechanics.** Application of soil mechanics to foundations of buildings; stability of earth slopes; earth pressure and retaining walls; braced cuts; damage due to construction operations. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: Civil Engineering 383 or equivalent. 4 hours or 1 unit.
385. **Terrain Analysis.** Use of geologic and pedologic information and airphoto interpretation techniques in the analysis of terrain for engineering purposes, correlations among physiographic regions, soil regions and engineering problems. Field trip; estimated cost, \$5.00. Prerequisite: Civil Engineering 280 or equivalent. 4 hours or 1 unit.
391. **Computer Methods in Civil Engineering.** Review of programming concepts; formulation and programming of numerical, data processing, and logical problems with applications to various branches of civil engineering: organization of programs and data; development and use of problem-oriented programming languages in civil engineering. Prerequisite: Computer Science 101 or equivalent; senior or graduate standing in civil engineering; or consent of instructor. 3 hours, or 1/2 or 1 unit.
403. **Analogue Photogrammetry, I.** Study of the fundamental concepts of the analogue approach in photogrammetry; characteristics, capabilities, and limitations of analogue photogrammetric data reduction systems; theory of errors of interior and exterior orientation methods of relative and absolute orientation; model deformations; critical surfaces. Prerequisite: Civil Engineering 201 or consent of instructor. 1 unit.
405. **Analytical Aerotriangulation.** Iterative and simultaneous rigorous block adjustment methods, numerical methods for the solution of large systems of equations; characteristics of various analytical photogrammetric systems. Prerequisite: Civil Engineering 306 or consent of instructor. 1 unit.
416. **Design of Construction and Industrial Operations, I.** Same as Industrial Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues and inventory models required for systems design; design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering, credit, or registration in Mathematics 363, or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Industrial Engineering 417. Continuation of Civil Engineering 416. Prerequisite: Civil Engineering or Industrial Engineering 416; credit or registration in Mathematics 315; or consent of instructor. 1 unit.
420. **System Approach to Pavement Design.** Concepts of system approach; pavement function and performance; evaluation of surface properties and relation to vehicle perform-

ance; analysis of subsystems and principal components; composition and properties of pavement mixtures; durability problems and controls. Prerequisite: Civil Engineering 220 or 221, or equivalent. 1 unit.

421. **Pavement Design, II.** Structural design of flexible and rigid pavements; loading characteristics, static, impact and repeated loads; load distribution through pavement layers, factors affecting distribution, methods of analysis; evaluation of subgrade support; criteria for selecting design values. Prerequisite: Civil Engineering 220 or equivalent. 1 unit.
422. **Fundamental Properties and Behavior of Bituminous Mixtures.** Composition and theories of physical structure of bitumens; rheological, failure, durability, and adhesive properties of bitumens and bituminous mixtures; analysis of factors influencing the performance of bituminous aggregate mixtures. Prerequisite: Civil Engineering 321 or consent of instructor. 1 unit.
423. **Highway Materials Stabilization.** Stabilization of aggregates and soils with cement, lime, bituminous materials, and other stabilizing agents; basic stabilization reactions, properties of stabilized materials, and composition design are emphasized. Prerequisite: Civil Engineering 220 or consent of instructor. 1 unit.
426. **Traffic Planning.** Traffic engineering planning functions; urban and rural master traffic plans; traffic analyses for new or existing streets, highways, and terminal facilities. Prerequisite: Civil Engineering 325 or equivalent. 1 unit.
427. **Geometric Highway Design.** Highway classification; highway capacity; highway design controls; sight distance; horizontal and vertical alignment; cross-section elements; highway types; controlled access highways; design of at-grade of intersections, grade separations, and interchanges. Prerequisite: Civil Engineering 325 and 426, or consent of instructor. 1 unit.
428. **Traffic Engineering Operations.** Theory of traffic control; laws and ordinances; design and application of traffic control devices; special street designations; parking design and control; street illumination; miscellaneous traffic control designs. Prerequisite: Civil Engineering 325 and 426, or equivalent. 1 unit.
435. **Railway Construction and Maintenance.** Roadbed load capacity; economic design of track; advanced geometric design; economics of maintenance; grade crossing separations; review of specific projects. Prerequisite: Civil Engineering 335. 1 unit.
436. **Railroad Location and Operation.** Track and traffic capacity; optimum train size, performance, and scheduling; validity and accuracy of current practices; regional operating factors; optimum size of plant and modern location. Prerequisite: Civil Engineering 336 or consent of instructor. 1 unit.
440. **Theory of Water Treatment.** Properties of water and criteria of water quality; gas transfer operations in water treatment; chemical treatment processes; corrosion and corrosion control; sedimentation; filtration; disinfection; control of aquatic growth; control of tastes and odors. Prerequisite: Chemistry 122; Microbiology 101. 1 unit.
441. **Analysis and Treatment of Water and Waste Water.** Physical, biological, and chemical analysis of water and waste water; field sampling techniques; removal of objectional impurities, principles of disinfection; determination of dissolved oxygen, biochemical oxygen demand, and chemical oxygen demand, nitrogen, sulfur, and phosphorous compounds in waste waters. Prerequisite: Credit or registration in Civil Engineering 440. 1 unit.
442. **Theory of Waste-Water Treatment.** Composition, properties, and analysis of wastes; microbiology of waste treatment; pollution of natural waters; sedimentation; chemical treatment; aerobic and anaerobic treatment processes; disposal of waste sludges. Prerequisite: Civil Engineering 346; Chemistry 122; Microbiology 101. 1 unit.
443. **Advanced Sanitary Engineering Laboratory.** Experimental and pilot plant studies of the operational characteristics for various physical, chemical, and biological unit operations and processes used in the treatment of water and waste water. Prerequisite: Civil Engineering 441; credit or registration in Civil Engineering 442. 1 unit.
444. **Industrial Water and Waste Treatment.** The theory and application of unit operations unique to the treatment of industrial water and wastes; advanced consideration of

- industrial waste problems of major industries; techniques of saline water conversions. Prerequisite: Credit or registration in Civil Engineering 440 and 442, or consent of instructor. 1 unit.
445. **Water Quality and Pollution.** Water quality standards and criteria for various beneficial uses; transport mechanisms for pollution in surface streams and ground water; fate of pollution and pollution control. Prerequisite: Civil Engineering 250 and 251; Mathematics 345. 1 unit.
446. **Design of Water and Waste Treatment Plants.** A study of the fundamental factors affecting choice of treatment units and combination of unit processes into an integrated plant. Prerequisite: Civil Engineering 440, credit or registration in Civil Engineering 442, or consent of instructor. 1 unit.
447. **Radioactive Waste Disposal.** Same as Nuclear Engineering 447. Sources and characteristics of radioactive wastes; methods of treatment; ultimate disposal; fate of radioisotopes in the environment; permissible levels in air and water; current levels in water supplies; water treatment methods; monitoring techniques; solid waste disposal; gaseous wastes disposal; air-monitoring; and reactor site selection and hazards evaluation. Prerequisite: Nuclear Engineering 398 or consent of instructor. 1/2 or 1 unit.
448. **Control of Air Pollution.** A study of air contaminants from all types of sources; deleterious effects of contaminants on plants, animals, and materials; determination of source strength; basic theory of control devices; air pollution surveys; and organization of control programs. Prerequisite: General Engineering 360. 1 unit.
449. **Analysis of Air Pollutants.** Laboratory analysis of common air pollutants; theory of operation of laboratory and automatic field instrumentation. Prerequisite: Credit or registration in Civil Engineering 448. 1/2 or 1 unit.
450. **Hydrologic Systems.** Application of systems concepts to simulate and analyze hydrologic cycle and its components in terms of various deterministic, probabilistic, stochastic, lumped, distributed, linear and nonlinear mathematical models for the purpose of planning and designing water resources projects. Prerequisite: Civil Engineering 350 or consent of instructor. 1 unit.
452. **Water Resources.** An advanced interdisciplinary course on water resources planning and development; geographic aspects; data collection; governmental functions; hydrologic implications; river hydraulics; hydraulic physical units and water quality; economic aspects; legal, political, and social problems; case studies. Prerequisite: Consent of instructor. 1 unit.
457. **Ground Water.** An advanced interdisciplinary course on ground water; hydrogeology; hydrodynamics of flow through porous media; ground water hydrology; hydraulics of wells; hydraulic analysis of seepage; ground water pollution; ground water resources. Prerequisite: Consent of instructor. 1 unit.
458. **Open-Channel Hydraulics.** Basic hydromechanics; flow types; channel characteristics; flow-profile computations; hydraulic jump analysis; design of nonerodible, erodible, and grassed channels and transitional structures; study of supercritical flow and unsteady flow; modern developments in theory and design practice; application of numerical method, method of characteristics, method of singular point, and electronic digital computers and analogs. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
461. **Matrix Formulation of Structural Analysis.** Development of structural analysis algorithms in matrix formulation: force and displacement vectors and transformations, element property matrices, representation of structures as assemblages of elements, displacement and force methods of analysis, selected advanced topics. Prerequisite: Civil Engineering 361 or equivalent. 1 unit.
463. **Optimization of Structures.** Structural design processes; formulation of problems in the optimization of structures; optimization of structural elements; minimum volume principles; use of mathematical programming in optimization of structural systems. Prerequisite: Consent of instructor. 1 unit.
465. **Structural Design in Metals.** Theories of behavior of structural metal members and their

components; interpretation of codes and specifications for the design of bridges and buildings. This course and Civil Engineering 475 form a unit in the study of theoretical and experimental investigations. Prerequisite: Bachelor of Science in engineering with courses in structures. 1 unit.

467. **Behavior of Reinforced Concrete Structures.** Ultimate strength and behavior of statically indeterminate reinforced concrete structures; applicability of elastic analysis to framed structures; analysis and design of floor slabs in buildings. Prerequisite: Civil Engineering 366. 1 unit.
469. **Thin Shell Structures.** Fundamental membrane and bending theories of shells; application of theories to analysis and design of folded plates and cylindrical, rotational, and translational shells; membrane stresses and deflections; and approximate bending solutions by variational, finite-difference, and finite-element methods. Prerequisite: Civil Engineering 473 or consent of instructor. 1 unit.
470. **Structural Safety and Reliability.** Development of concepts and methods of probabilistic structural mechanics relevant to the analysis of structural safety and reliability. Concepts of probability and stochastic processes; statistical consideration of loads and structural resistances; engineering significance of statistical extremes; factor of safety and failure probability; prediction of system reliability; design for safety against natural destructive forces including wind and earthquakes. Prerequisite: Consent of instructor. 1 unit.
471. **Numerical and Approximate Methods of Structural Analysis.** Methods of successive approximations and numerical procedures for the solution of complex problems with applications to bridges, buildings, and aircraft structures: influence lines, moments and deflections of beams with axial load, buckling strength of columns, moments and deflections of beams resting on elastic or plastic supports, vibration of beams, analysis of arches, moments, and deflections of plates; other problems. 1 to 2 units.
473. **Analysis and Design of Plates and Shells.** Fundamental theories of bending and buckling of plates; practical application of theories in analysis and design of reinforced concrete bridges and building floors, highways and airport pavements, and structural plate components in metal; theory of shells with application to tanks, pressure vessels, shell roofs, and hipped plate construction. Prerequisite: Consent of instructor. 1 to 2 units.
474. **Dynamics of Framed Structures.** Advanced treatment of the dynamics of multi-degree of freedom framed structural systems; fundamental concepts of eigenvalue theory of real matrices and energy principles of dynamics as bases for a unified approach to dynamical problems of structural assemblages; structural idealizations, principles of dynamics, Lagrange's equations, response calculations, normal mode method and its limitations, transfer matrix approach, computer utilization. Prerequisite: Civil Engineering 361, 374, or equivalent. 1 unit.
475. **Behavior of Steel Structures.** A critical evaluation of the actual behavior of metals, connections, members, and structures; the significance of this behavior in terms of design and the development of design specifications. This course and Civil Engineering 465 form a unit in the study of theoretical and experimental investigations. Prerequisite: Graduate standing in civil engineering or theoretical and applied mechanics. 1 unit.
476. **Plastic Analysis and Design.** Inelastic behavior of metal structural frameworks; concept of the plastic hinge; collapse configurations; analysis of collapse mechanisms; requirements for stability; deflections, incremental collapse, shakedown; connections; optimum design; grid framework. Prerequisite: Civil Engineering 465 or consent of instructor. 1 unit.
478. **Discrete Methods of Solid and Structural Mechanics.** Concepts and methods for the discrete formulation and solution of structural and solid mechanics problems. Discrete idealization of solid media and structures by lumped-parameter and finite element approaches; stress analysis and wave propagation in plane and axis-symmetric solids; analyses of plate and shell structures; inelasticity and non-linearity; special boundary conditions; special problems, including soil and rock mechanics problems, and structure-

- medium interaction. Prerequisite: Civil Engineering 379, Aeronautical and Astronautical Engineering 326 or Theoretical and Applied Mechanics 351 or equivalent, and registration in Computer Science 400 or equivalent; or consent of instructor. 1 unit.
480. **Earth Pressures and Retaining Structures.** Classical and modern earth pressure theories and their experimental justification; pressures and bases for design of retaining walls, bracing of open cuts, anchored bulkheads, cofferdams, tunnels, and culverts. Prerequisite: Credit or registration in Civil Engineering 384. 1 unit.
481. **Earth Dams and Related Problems.** Fundamentals of problems of slope stability; seepage in composite sections and anisotropic materials; methods of stability analysis; mechanism of failure of natural and artificial slopes; compaction; field observations. Prerequisite: Credit or registration in Civil Engineering 384, or consent of instructor. 1 unit.
482. **Advanced Soil Mechanics, I.** Theoretical and experimental studies in soil mechanics, stress distribution in homogeneous and stratified soils, theory of consolidation for multidirectional flow and time dependent loading, numerical methods, secondary consolidation, settlement analysis, experimental measurements. Prerequisite: Civil Engineering 383. 1 unit.
483. **Advanced Soil Mechanics, II.** Theoretical and experimental studies in soil mechanics, shearing properties of saturated soils, physical properties of partially saturated soils, physicochemical properties of clays, laboratory direct shear and triaxial shear testing. Prerequisite: Civil Engineering 383. 1 unit.
484. **Foundation Engineering.** Critical study of case histories of projects in foundation engineering; current procedure for design and construction of foundations, embankments, and waterfront structures. Prerequisite: Civil Engineering 384. 1 unit.
485. **Soil Engineering for Transportation Facilities.** Systems of soil classification; application of statistical methods to soil engineering; relation of mineralogy to engineering properties; soil water migration and volume change; soil structure and stabilization by compaction; soil freezing and pavement behavior; behavior under repeated loading; stability of base embankments. Prerequisite: Civil Engineering 383 or equivalent. 1 unit.
486. **Rock Mechanics, I.** Physical properties and classification of intact rock, theories of rock failure, state of stress in the earth's crust, stresses and deformations around underground openings assuming elastic, plastic, and time-dependent behavior; effect of geologic discontinuities on rock strength; introduction to stability analyses in rock. Prerequisite: Civil Engineering 383; Geology 450 or equivalent; Theoretical and Applied Mechanics 321 or equivalent; or consent of instructor. 1 unit.
487. **Rock Mechanics, II.** Application of rock mechanics to engineering problems; shear strength of rock masses; dynamic and static stability of rock slopes; deformability of rock masses; design of pressure tunnel linings and dam foundations; controlled blasting and blasting vibrations; tunnel support; machine tunneling; design and construction of large underground openings; field instrumentation. Prerequisite: Civil Engineering 486 or consent of instructor. 1 unit.
494. **Municipal Administration and Engineering.** Legal authority of municipalities, forms of municipal government; municipal functions, organization, and management; city finance; engineering functions of city government; city planning and zoning; building codes and inspection; street lighting, public utilities; city cleaning, recreational development. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
495. **Civil and Environmental Engineering Seminar.** Discussion of current topics in civil and environmental engineering and related fields by staff, students, and visiting lecturers. 0 to 1/4 unit. Course may be repeated.
497. **Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by his adviser and the staff member who will supervise the investigation. Prerequisite: Consent of instructor. 0 to 4 units.
499. **Thesis Research.** 0 to 4 units.

CLASSICS

(Including Classical Archaeology, Classical Civilization, Greek, Hebrew, and Latin)

Head of Department: Professor J. J. BATEMAN

Department Office: 4072 Foreign Languages Building

MAJOR IN GREEK

Major: Twenty hours of Greek, excluding Greek 101 and 111, and including six hours of 300-level courses.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, art, Asian studies, English (excluding Rhetoric 101, 102, 103, 107, 108), foreign language (Latin being especially recommended), history, linguistics, medieval civilization, philosophy, political science, religious studies, sociology, and speech. A topical minor or minors in other subjects may be accepted with the approval of the department adviser.

Departmental Distinction: Distinction in Greek may be achieved by a student who satisfactorily completes four semester hours in Greek 291 or 293 in addition to the requirements of the major in Greek. A student eligible for College Honors qualifies for enrollment in these two courses; a student not eligible for College Honors may be admitted to these courses by the approval of the departmental Honors Committee.

The level of Distinction is determined by the department on the basis of the thesis, but High Distinction is not awarded to students whose average grade for all courses in Greek is less than 4.5.

Note: Credit for New Testament Greek transferred from other institutions is not counted toward a major or minor until after the satisfactory completion of Greek 201 or 202, and then only to a possible maximum of twelve hours as the equivalent of Greek 111-112 and 200. and three hours as the equivalent of one semester of Greek 391.

MAJOR IN LATIN

Major: Twenty hours, excluding Latin 101, 102, and 103, and including nine hours of 300-level courses. In addition, Classical Civilization 301-302 is strongly recommended as an elective. See also the Undergraduate Study catalog, curriculum preparatory to the teaching of Latin.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, art, Asian studies, English (excluding Rhetoric 101, 102, 103, 107, 108), foreign language (Greek being especially recommended), history, linguistics, medieval civilization, philosophy, political science, religious studies, sociology, and speech. A topical minor or minors in other subjects may be accepted with the approval of the departmental adviser.

Departmental Distinction: Distinction in Latin may be achieved by a student who satisfactorily completes four semester hours in Latin 291 or 293 in addition to the requirements of the major in Latin. A student eligible for College Honors qualifies for enrollment in these two courses; a student not eligible for College Honors may be admitted to these courses by the approval of the departmental Honors Committee.

The level of Distinction is determined by the department on the basis of the comprehensive examination, but High Distinction or Highest Distinction is not awarded to students whose average grade for all courses taken in Latin is less than 4.5.

Classical Archaeology

Note: The following 300-level courses presuppose no knowledge of the Greek and Latin languages and are open to all students.

331. **The Archaeology of Greece.** Monuments and material remains illustrating the develop-

ment of Greek civilization to 323 B.C. Prerequisite: a course in ancient history, art, or language, or consent of instructor. 3 hours or 1/2 unit. ALLEN.

332. **The Archaeology of Italy.** Monuments and material remains illustrating the development of Graeco-Roman and other Ancient Italian civilizations to 330 A.D.. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours or 1/2 unit. ALLEN.
335. **The Topography of Athens.** A survey of the topography, monuments, and architecture of ancient Athens. Prerequisite: Classical Archaeology 331 or equivalent, or consent of instructor 3 hours or 3/4 or 1 unit. ALLEN.
336. **The Topography of Rome.** A survey of the topography, monuments, and architecture of ancient Rome. Prerequisite: Classical Archaeology 332 or equivalent, or consent of instructor. 3 hours, or 3/4 or 1 unit. ALLEN.
433. **The Archaeology of Magna Graecia and Sicily.** Problems in the archaeology of Magna Graecia and Sicily. 1 unit. Prerequisite: Classical Archaeology 331 and 332, or equivalent. ALLEN.
435. **Field Work.** Participation in archaeological excavation; methods and procedures are discussed and practiced in actual working conditions. 1 unit. Prerequisite: Consent of instructor. ALLEN.

Classical Civilization

Note: The following 300-level courses presuppose no knowledge of the Greek or Latin language and are open to all students. For other courses in the area of classical civilization, see Architecture 211; Art 111, 301, 302, 303, 304, 305, 306, 307; History 181, 182, 381, 382, 383, 384; Philosophy 303, 309, 310; Political Science 393.

100. **Vocabulary Building from Greek and Latin Roots.** Vocabulary building assistance for students through an analysis of Greek and Latin roots, prefixes, and suffixes found in English. 2 hours.
110. **Introduction to Greek Culture.** The study of social and cultural life in Greece during the Classical Period. 2 hours
111. **Mythology of Greece and Rome.** 2 hours.
112. **The Roman Achievement.** Introduction to Roman civilization through the study of the social and cultural life of ancient Rome. 2 hours.
221. **The Heroic Tradition.** A study of ancient epics and their relation to the social consciousness of their period. Introductory and background lectures; readings in the epic tradition of antiquity and its successors. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
222. **The Tragic Spirit.** Readings in the tragic drama of Greece and Rome—a systematic study of the contents and development of this classical literary/dramatic genre. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
301. **Greek Literature in Translation.** An introduction to Greek literature from Homer to Hellenistic age and to its cultural and historical background. Prerequisite: Consent of instructor. 3 hours.
302. **Latin Literature in Translation.** An introduction to Latin literature of the classical period and to its cultural and historical background. Prerequisite: Consent of instructor. 3 hours.
331. **Satire and Social Criticism.** Same as Comparative Literature 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in the Greek Old Comedy and Roman Satire, or by suggesting escape, as in the new comedy of manners and the prose romances. Some attention to the tradition of satire in mediaeval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit.
332. **The Ancient Ideal in Art and Literature.** A study of the aesthetic standards and theories

of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit.

347. **The Age of Charlemagne.** The Carolingian Age and its intellectual, political, social, and cultural significance for western civilization. Prerequisite: Junior standing or consent of instructor. 3 hours, or 3/4 or 1 unit.

Greek

101. **Elementary Greek.** An introduction to the fundamentals of classical Greek, including the reading of simple prose. No credit toward graduation is given for Greek 101 without Greek 102. 4 hours.
102. **Elementary Greek.** Continuation of Greek 101. Grammar and reading. Prerequisite: Greek 101 or equivalent. 4 hours.
111. **Elementary Koine Greek.** Same as Religious Studies 111. An introduction to the fundamentals of Koine Greek, including reading from the New Testament. No credit toward graduation is given for Greek 111 without Greek 112. 4 hours.
112. **Elementary Koine Greek.** Same as Religious Studies 112. Continuation of Greek 111. Grammar and reading. Prerequisite: Greek 111 or equivalent. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elementary Koine Greek.** Same as Religious Studies 200. Reading of narrative and epistolary New Testament Greek. Prerequisite: Greek 112 or equivalent. 4 hours.
201. **Second-Year Greek.** Reading of Attic prose. Prerequisite: Greek 102 or equivalent. 4 hours.
202. **Second-Year Greek.** Continuation of Greek 201. Introduction to epic Greek; reading of Homer. Prerequisite: Greek 201 or equivalent. 4 hours.
291. **Senior Thesis.** Open to candidates for Distinction in Greek. Prerequisite: Senior standing 2 or 4 hours.
293. **Senior Survey.** Thesis and honors. For candidates for honors in Greek and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
301. **Third-Year Greek.** Readings in Attic prose. Prerequisite: Greek 202. 3 hours or 1/2 unit.
302. **Third-Year Greek.** Continuation of Greek 301. Readings in Greek tragedy. Prerequisite: Greek 301. 3 hours or 1/2 unit.
308. **Comparative Grammar of Greek and Latin.** Same as Latin and Linguistics 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or 1/2 unit.
309. **The Structure of Greek.** A linguistic analysis of the morphology and syntax of the Greek language. Prerequisite: Greek 202 or equivalent. 3 hours or 3/4 unit.
311. **Greek Prose Composition.** Practice in the writing of Greek prose. Prerequisite: Greek 201 or equivalent. 3 hours or 3/4 unit.
312. **Sight Translation.** Exercise in the sight translation of passages of Greek authors. Prerequisite: Greek 202 or equivalent. 3 hours or 3/4 unit.
371. **The Gospels.** Same as Religious Studies 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or 3/4 or 1 unit.
381. **Readings in Narrative Prose.** Readings chosen by the instructor from the following authors: Herodotus, Thucydides, *Hellenica Oxyrhynchia*, Polybius, Plutarch's *Lives*. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.
382. **Lyric Poetry.** Readings chosen by the instructor from the extant corpus of lyric, elegiac, iambic, and bucolic poetry. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.

383. **Oratory.** Readings chosen by the instructor from one or more of the Attic orators or the orators of the Second Sophistic. Prerequisites: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.
384. **Epic Poetry.** Readings from one or more of the following: Homer, *Iliad*, Hesiod, *Works and Days*, Homeric hymns, Apollonius of Rhodes. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.
385. **Philosophical Authors.** Readings from Plato, Aristotle, Xenophon's *Memorabilia*, or other philosophical texts. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.
386. **Attic Drama.** Readings from Aeschylus, Sophocles, Aristophanes, or Menander. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit.
391. **Readings in Greek Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Greek. Prerequisite: Greek 302 or equivalent. 3 hours, or 3/4 or 1 unit. May be repeated to a maximum of 12 hours of credit.
409. **Greek Versification.** Greek prosody; survey of meters, lines, and cola in epic, lyric, and dramatic poetry; lyric meters of Greek drama. 1 unit.
411. **Hellenistic Literature.** 1 unit. BATEMAN, NEWMAN.
413. **Greek Lyric Poetry.** 1 unit. NAOUMIDES.
414. **Pindar.** 1 unit. NAOUMIDES.
415. **Homer.** 1 unit. MARCOVICH.
416. **Thucydides.** 1 unit. NAOUMIDES.
417. **Bacchylides.** 1 unit. NAOUMIDES.
420. **Plato.** Prerequisite: Greek 391 or equivalent. 1 unit. MARCOVICH.
422. **Sophocles.** 1 unit.
423. **Aeschylus.** 1 unit.
424. **Euripides.** 1 unit.
425. **Greek Drama: Comedy.** 1 unit.
441. **Greek Palaeography.** History and development of Greek writing from the third century B.C. to the end of the fifteenth century A.D. Prerequisite: Greek 302 or equivalent. 1 unit. NAOUMIDES.
460. **Studies in Patristic Greek Literature.** Aspects of the religious and social history of early Christianity on the basis of Greek Patristic texts. 1 unit. SCHOEDEL.
491. **Directed Reading.** Prerequisite: Second-year graduate standing. 1/4 to 1 unit; no student may offer more than 1 unit of credit in this course toward the Ph.D. degree.
495. **Bibliography and Criticism.** Same as Latin 495. Introduction to the methods and techniques of scholarship. 1/2 unit. OLIVER.
496. **Bibliography and Criticism.** Same as Latin 496. 1/2 unit. OLIVER.
499. **Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

Hebrew

110. **Introduction to Biblical Hebrew.** Same as Religious Studies 108. Stress on mastery of grammar, reading, writing, simple prose composition. Reading for simple Biblical prose. 4 hours.
111. **Introduction to Biblical Hebrew.** Same as Religious Studies 109. Syntax and reading of simple classics prose narrative. Prerequisite: Hebrew 110 or Religious Studies 108. 4 hours.
210. **Biblical Prose.** Same as Religious Studies 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Hebrew 110 and 111 or Religious Studies 108 and 109. 4 hours.
211. **Biblical Poetry.** Same as Religious Studies 211. Reading and discussion of the Book of

Amos and of selections from the Psalms; exercises in prose composition. Prerequisite: Hebrew 210. 4 hours.

Latin

101. **Elementary Latin.** Grammar and reading. For students who have had no work in Latin. No credit toward graduation is given for Latin 101 without Latin 102. 4 hours.
102. **Elementary Latin.** Grammar and reading of easy prose. Prerequisite: Latin 101 or one year of high school Latin. 4 hours.
103. **Intermediate Latin.** Review of grammar; reading of easy narrative prose. Prerequisite: Latin 102 or two years of high school Latin. 4 hours.
104. **Introduction to Latin Literature.** Continuation of Latin 103, with readings chiefly in Latin poetic literature. 4 hours.
113. **Latin Composition.** Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Credit or registration in Latin 103 or three years of high school Latin. 2 hours.
114. **Latin Composition.** Continuation of Latin 113. Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Latin 113. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Survey of Latin Literature.** The Republican period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
202. **Survey of Latin Literature.** The Imperial period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
203. **Cicero and the Roman Republic.** A course in the political writings of Cicero, emphasizing the events of his consular year. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
204. **Vergil and the Augustan Age.** A course in the poetry of Vergil emphasizing ancient epic as a literary genre and the historical background to the *Aeneid*. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
280. **Teachers Course.** An introduction to the problems of the teaching of Latin and a study of textbooks. Required of teacher-training majors in Latin. This course will not meet during the six-week student teaching period. Prerequisite: Latin 202; senior standing. 2 hours.
291. **Senior Thesis.** Thesis and honors. For candidates for honors in Latin and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
293. **Senior Survey.** Thesis and honors. For candidates for honors in Latin and for other seniors. 2 or 4 hours.
307. **The Structure of Latin.** A linguistic analysis of the morphology and syntax of the Latin language. Prerequisite: Latin 204 or equivalent. 3 hours or 3/4 unit.
308. **Comparative Grammar of Greek and Latin.** Same as Linguistics and Greek 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or 1/2 unit.
311. **Intermediate Prose Composition.** Practice in the writing of Latin prose. Prerequisite: Latin 114 or equivalent. 3 hours or 3/4 unit.
312. **Advanced Composition.** Practice in the writing of Latin prose and verse. Prerequisite: Latin 311. 3 hours or 3/4 unit.
313. **Oral Latin.** Introduction to the use of Latin as a means of oral communication, with particular reference to instruction in secondary schools. Prerequisite: Latin 312 or consent of instructor. 2 hours or 1/2 unit. Offered in the summer session only.
360. **Patristic Latin.** Same as Religious Studies 360. Literary and historical texts in prose and

- poetry from Tertullian to Jerome and Augustine. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or 3/4 or 1 unit.
361. **Medieval Latin.** Literary and historical texts in prose and poetry from Cassiodorus to Roger Bacon. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or 3/4 or 1 unit.
381. **Roman Comedy.** Selections from the plays of Plautus and Terence. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
382. **Latin Lyric Poetry.** Selections from the poems of Catullus and Horace. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
383. **Roman Philosophical Authors.** Selections from Lucretius and from the essays of Cicero. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
384. **Roman Historians.** Selections from Caesar, Livy, and Tacitus. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
385. **Roman Epistolography.** Selections from the epistolary prose of Cicero, Seneca, and Pliny. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
386. **Latin Elegy.** Readings in Ovid, Propertius, and Tibullus. Prerequisite: Latin 204 or equivalent. 3 hours, or 3/4 or 1 unit.
391. **Readings in Latin Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Latin. Prerequisite: Three years of college Latin or equivalent; consent of instructor. 3 hours, or 3/4 or 1 unit. May be repeated to a maximum of 12 hours of credit.
400. **Beginning Latin for Graduate Students.** Basic grammar, syntax, and vocabulary; reading practice. Designed for graduate students who need to use Latin in their research. 0 credit.
401. **Readings in Latin for Graduate Students.** Directed readings, largely in medieval and modern Latin. Designed for graduate students who need to use Latin in their research. 0 credit. Prerequisite: Latin 400 or two years of high school Latin or equivalent.
402. **Teaching College Latin.** A course designed for new graduate teaching assistants in the Classics Department. New techniques are examined for teaching pronunciation, vocabulary, grammar, and the reading of Latin. Class is closely correlated with the teaching assignments of the graduate students. No credit.
409. **History of the Latin Language.** 1 unit. Prerequisite two years of college Latin or equivalent; two years of modern foreign language. HELLER.
410. **Vulgar Latin.** 1 unit. Prerequisite: Two years of college Latin; two years of a Romance language. HELLER.
411. **Latin Epigraphy.** 1 unit. Prerequisite: Three years of college Latin or equivalent; one year of ancient history. OLIVER.
412. **Latin Elegy.** 1 unit. OLIVER.
413. **Caesar.** 1 unit. BATEMAN.
414. **Lucan.** 1 unit. OLIVER.
415. **Lucretius.** 1 unit. JACOBSON.
416. **Vergil.** 1 unit. NEWMAN.
417. **Ovid.** A study of the works of Ovid with special emphasis on literary and philosophical problems. 1 unit. Prerequisite: Four years of college Latin or equivalent. JACOBSON.
421. **Horace.** 1 unit. MARCOVICH, NEWMAN.
422. **Plautus and Terence.** 1 unit.
423. **Latin Romance.** 1 unit.
425. **Cicero.** 1 unit.
426. **Tacitus.** The *Annales*. 1 unit. OLIVER.
427. **Roman Satire.** 1 unit. HELLER.
441. **Latin Paleography.** 1 unit. WALLACH.

- 460. Bibliography and Criticism of Medieval Latin.** Introduction to research in Medieval and Patristic Latin. 3/4 or 1 unit. Prerequisite: Latin 360, 361, or equivalent. WALLACH.
- 461. The Medieval Latin Bible.** Study of the Vulgate and earlier Latin versions of the Bible and of the commentaries of the Latin Fathers. 1 unit. Prerequisite: Latin 360, 361, or equivalent. WALLACH.
- 462. The Carolingian Renaissance.** Same as Comparative Literature 454. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. 1 unit. Prerequisite: Latin 360, 361, or equivalent. WALLACH.
- 491. Directed Reading.** 1/4 to 1 unit; no student may offer more than 1 unit of credit in this course toward the Ph.D. degree. Prerequisite: Second-year graduate standing.
- 495. Bibliography and Criticism.** Same as Greek 495. Introduction to the methods and techniques of scholarship. 1/2 unit. OLIVER.
- 496. Bibliography and Criticism.** Same as Greek 496. 1/2 unit. OLIVER.
- 499. Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

COMMUNICATIONS

Chairman of Committee on Graduate Study: Professor J. W. CAREY
Office: 1207 West Oregon Street, Urbana

The committee on Graduate Study in Communications administers an interdisciplinary program leading to the degree of Doctor of Philosophy in Communications. These courses are taught by faculty members of the various departments with which they are cross-listed. Undergraduate students in the College of Communications may count only those communications courses cross-listed with journalism courses and radio and television courses as fulfilling the graduation requirement of thirty hours in courses offered by the College of Communications.

- 217. History of Communications.** Same as Journalism 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; communications and the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
- 218. Communications and Public Opinion.** Same as Journalism 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
- 220. Processes and Systems of Communications.** Same as Journalism 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communication. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
- 231. Mass Communications in a Democratic Society.** Same as Journalism 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
- 241. Law and Communications.** Same as Journalism 241. The historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
- 251. Social Aspects of Mass Communications.** Same as Journalism and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.

307. **The Art of the Screen: Narration.** Same as Speech 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or 1/2 or 1 unit.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Speech 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Speech 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or 1/2 or 1 unit.
319. **Russian and East European Cinema.** Same as Humanities, Slavic, and Speech 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or 3/4 unit.
325. **Introduction to Psycholinguistics.** Same as Linguistics 325. An introductory survey of psychological and linguistic approaches to the study of communications. Prerequisite: Credit or registration in Linguistics 300. 3 hours or 1 unit.
344. **Public Opinion.** Same as Sociology 344. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. Prerequisite: Sociology 100 or 151; junior standing. 3 hours or 1/2 unit.
351. **Advanced Social Psychology.** Same as Psychology and Sociology 351. An integrative treatment of individual behavior variables in relation to group variables. Prerequisite: Psychology 201 or Sociology 201 and Psychology 235 or Sociology 385 or a comparable statistics course. 3 hours, or 1/2 or 1 unit.
352. **Attitude Theory and Change.** Same as Psychology and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change. Emphasis is on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201, or a comparable course of introduction to social psychology. 3 hours, or 1/2 or 1 unit.
370. **Language, Culture, and Society.** Same as Anthropology and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, one course in communications or linguistics, or consent of instructor. 3 hours, or 1/2 or 1 unit.
377. **International Communications.** Same as Political Science 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; government-industry relations in communications. 3 hours or 1 unit.
414. **Seminar on Social Interaction.** Same as Sociology 414. An analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas. Problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
420. **Seminar in Semantics.** Same as Philosophy 420. Intensive study of important contemporary contributions in the fields of semantics, analytic philosophy, and the philosophy of language. 3/4 or 1 unit. May be repeated for credit.
424. **Developmental Psycholinguistics.** Same as Linguistics and Psychology 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Linguistics and Psychology 425. A critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic, information-theory, and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.

426. **Research Seminar in Psycholinguistics.** Same as Linguistics and Psychology 425. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course plan, execute, and report an original piece of research in this area. Prerequisite: Communications 425; consent of instructor. 1/2 or 1 unit.
432. **Books and Libraries Since the Renaissance.** Same as Library Science 432. The study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
436. **Problems of Cybernetics.** Same as Biophysics 436 and Electrical Engineering 474. The study of brain-like processes in complex dynamic systems with emphasis on unsolved problems, current developments, and opportunities for research. Prerequisite: Consent of instructor. 1 unit.
444. **Seminar in Public Opinion.** Same as Sociology 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; mass media and public opinion. 1 unit.
456. **Attitude Measurement and Behavioral Prediction.** Same as Psychology 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction. Emphasis is on the attitude concept and the validity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.
462. **Seminar in Radio and Television.** Same as Radio and Television 462. A study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
463. **World Broadcasting.** Same as Radio and Television 463. A study of the broadcast systems used by the nations of the world; alternative and "mixed" systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other countries; implications of such new developments as satellites; mass and non-mass uses. Prerequisite: Radio and Television 462 or consent of instructor. 1 unit.
468. **The Political Economy of Communications.** Same as Journalism 468. Analysis of the structure, policy, and behavior of such media of communications as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film, with special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
470. **Communications and Popular Culture.** Same as Journalism 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
471. **Proseminar in Communications, I.** Same as Journalism 471. A general discussion of the mass media of communications, their role as social institutions, their control and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
472. **Proseminar in Communications, II.** Same as Journalism 472. A general discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
473. **History and Theory of Freedom of the Press.** Same as Journalism 473. Development of the Anglo-American press system and the idea of freedom of the press; contemporary mass media and their implications for freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
474. **Communications Systems.** Same as Journalism 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. 1 unit. Prerequisite: Consent of College of Communications.
481. **Economic and Social Aspects of Advertising.** Same as Advertising 481. An examination of advertising as an institution; the economic, social, and legal aspects of advertising with

- focus on current problems. Students may not receive graduate credit for both Communications 481 and Advertising 388. Prerequisite: Consent of department. 1 unit.
482. **Research Methods in Advertising and Communications.** Same as Advertising 482. A treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications. Both nonquantitative and quantitative methods are examined. Prerequisite: A basic course in statistical methods; consent of department. 1 unit.
490. **Special Topics in Communications.** 1/2 to 2 units. Prerequisite: Consent of chairman of Committee on Graduate Study in Communications.
492. **Research Methods in Communications.** Same as Journalism 492. An introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication, with emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
499. **Thesis Research.** Prerequisite: Consent of chairman of Committee on Graduate Study in Communications and of thesis supervisor. 0 to 4 units. Students may reregister for a total of 8 units.

COMPARATIVE LITERATURE

Director of Graduate Program in Comparative Literature: Professor H. KNUST

203. **Goethe in Translation.** Same as German 203. Introduction to the life and works of Wolfgang Goethe. Focus is on his poetic work, but his major contributions to science are also treated as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as German 204. German medieval precourtly and courtly literature in translation. Readings in the works of Hartmann, Gottfried, Wolfram, Walther, and others, including the following epics: *Nibelungenlied*, *Gregorius*, *Tristan*, *Parzival*. 3 hours.
309. **Contemporary Persian Literature and Western Influence.** Readings in modern Persian literature in translation, and the study of selected European novels and works on literary theory with specific attention to Western influence on Persian literature. Prerequisite: Consent of instructor. 3 hours, or 1/2 to 1 unit.
313. **The Divine Comedy.** Same as Italian 313. An interpretation of Dante's *Divine Comedy* with special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or 1/2 unit. DAHANE.
331. **Satire and Social Criticism.** Same as Classical Civilization 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in Greek Old Comedy and Roman Satire, or by suggesting escape, as in the new comedy of manners and the prose romances. Some attention to the tradition of satire in mediaeval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit.
359. **The International Folk Tale.** Same as English 367. A study of the origin, distribution, and nature of the folk tale with special reference to themes and variants. Representative tales of various areas (Africa, Germany, Greece, India, Ireland, Japan, Norway) are analyzed, and North American Negro and Indian tales are discussed. 3 hours or 3/4 unit. FLANAGAN.
363. **Introduction to Comparative Literature, I.** Same as Humanities 363. A one-year course in two parts, offering a survey of methods and goals of comparative literature, illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or 3/4 unit. SMALLEY.
364. **Introduction to Comparative Literature, II.** Same as Humanities 364. Continuation of Comparative Literature 363. 3 hours or 3/4 unit. SMALLEY.

394. **Introduction to Folklore: History, Theory, Methods.** Same as English 387, German and Slavic 394, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or 3/4 unit.
401. **Theory of Literature.** The methods and objectives of the discipline of comparative literature. 1 unit. Prerequisite: Reading knowledge of two foreign languages; consent of instructor.
431. **Comparative Slavic Literature.** Same as Slavic 431. A survey of Slavic literature, especially Czech, Polish, and Yugoslav, and their connection with Russian and Western traditions. 1 unit.
451. **Seminar in Literary Movements and Periods.** An investigation of the development and mutation of literary movements (classicism, romanticism, symbolism, etc.) through a study of critical texts and their reception in various countries. The subject of the seminar varies each semester, and it may be taken more than once for a total of three units. 1 unit.
452. **Seminar in Romantic Literature.** Same as English 433. Prerequisite: A college course devoted entirely to an aspect of Romantic studies, or consent of instructor. 1 unit. May be repeated as topic varies.
454. **The Carolingian Renaissance.** Same as Latin 462. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. 1 unit. Prerequisite: Latin 360 or 361, or equivalent.
461. **Seminar in Literary Genres and Forms.** A study of a form (the lyric, the novel, the drama, etc.) to discover its essential components in all the literatures studied and the significance of national variations. The subject of the seminar varies each semester, and it may be taken more than once for a total of three units. 1 unit.
462. **Seminar in Spanish-American Novel.** Same as Spanish 436. Special problems in methodology and research. Includes other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit.
471. **Seminar in Literary Relations.** An investigation of the impact of one literature upon another, or of some specific works upon others (the role of English literature in Continental Europe; the influence of Russian novelists on French and German writers, etc.) The subject of the seminar varies each semester. 1 unit. Course may be taken more than once for a total of 3 units.
472. **Studies in French and Comparative Cinema.** Same as French 452. Historical, aesthetic, social, and technical studies of the French cinema and its development and relation to world cinema and to literature. 1 unit.
473. **Seminar in French and Comparative Cinema.** Same as French 482. Study of several major French directors within the context of French and international cinema. Comparison with selected non-French directors. Relationships of films and other literary forms. 1 unit.
478. **Seminar in Twentieth-Century French Literature.** Same as French 478. Discussion and research on some specialized topic in twentieth-century French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
481. **Seminar in Literary Themes and Types.** A study of a theme or type (the Faust myth, the romantic hero, etc.) to discover its essential components in all the literatures studied and the significance of national variations. The subject of the seminar varies each semester. 1 unit. Course may be taken more than once for a total of 3 units.
493. **Special Studies.** 1/4 to 1 unit.
499. **Thesis Research.** Intended for students engaged in writing a thesis as a partial requirement for the A.M. or Ph.D. degree in comparative literature. Maximum credit for master's candidates is 2 units. 0 to 4 units.

COMPUTER SCIENCE

Head of Department: Professor J. N. SNYDER

Department Office: 252 Digital Computer Laboratory

MAJOR IN MATHEMATICS AND COMPUTER SCIENCE IN SCIENCES AND LETTERS CURRICULUM

Note: This major is offered by the Department of Mathematics under the curriculum in sciences and letters for students of mathematics who have a special interest in the use of computers.

Major: Mathematics 120, 130, 140 (or 131, 141), 341, 342, 317, 318, 347, 348 (or 361).

First Minor: Computer Science 121, 201, 287, and one of Computer Science 293, 294, 301, 310.

Second Minor: At least eight hours in a subject approved by the department; not required of students with twenty hours or more of computer science courses.

Note: In special circumstances, with the consent of the adviser, other 100-level beginning computer science courses may be substituted for Computer Science 121.

Distinction in Mathematics and Computer Science: A student who satisfies the following requirements may, upon recommendation of the Departments of Mathematics and of Computer Science, be graduated with Distinction in mathematics and computer science: (1) Satisfy the College of Liberal Arts and Sciences requirements for graduation; (2) Complete the minimum requirement of the major in mathematics and computer science with a grade-point average of at least 4.25 in all mathematics and computer science courses; (3) Complete three hours of additional courses chosen from Computer Science 109, 209, 290, 301, 306, 311, 385, 387, 391, 392, 393, 394, 397; (4) Register his candidacy for Distinction with his adviser no later than the end of his junior year.

101. **Introduction to Automatic Digital Computing.** A beginning course covering topics in machine organization, problem formulation, automatic programming, numerical analysis, machine language programming, and applications of computers. Students use the computing facilities of the department for solving problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 3 hours.
103. **Introduction to Social and Behavioral Science Digital Computer Programming.** A beginning course in computer programming for students with an interest in behavioral and social science computation; instruction in programming languages (FORTRAN and PL/I) with an emphasis on applications from statistical and data manipulative procedures. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. Prerequisite: Sophomore standing; one year of college mathematics or statistics. 3 hours.
105. **Introduction to Computers and Their Application to Business and Commerce.** An introduction to computer fundamentals, higher language programming, and the use of the computer for the solution of business problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 3 hours.
106. **Introduction to Computers for Teachers.** Same as Secondary and Continuing Education 106. An introduction to the principles of computer operation and programming, and their applications to education. Students use computers to solve problems. Credit may be received for only one of the following: Computer Science 101, 103, 105, 106, 107, 121. 3 hours.
107. **Introduction to Computers for Secondary School Teachers of Mathematics.** A beginning course covering principles of digital computer operation, programming in machine and higher level languages, and applications. Intended to make teachers aware of the possibilities that computers have in education in the mathematical sciences. Students use computers to solve problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. Prerequisite: One year of college calculus. 3 hours.

109. **Honors Course in Computer Science.** All students in a mathematics honors course, or all students whose grades in mathematics within the past year were "A" are admitted to this course without examination. Others are admitted upon passing a special examination administered by the department. Enrollment is strictly limited to students with superior talents in computer science. Prerequisite: Registration in Computer Science 101, 103, 105, 107, or 121. 1 hour.
121. **Introduction to Computer Programming.** The beginning course for students in the mathematics and computer science curriculum, and for other interested students. The course covers topics in digital computer organization, problem formulation, programming languages, and the solution of numerical and nonnumerical problems. Students write several programs to find solutions to problems using digital computers. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Machine Language and System Programming, I.** Principles of machine language programming; organization of computers and its effect on computer software; interpretation and assembly language translation. Prerequisite: Computer Science 101 or 121, or consent of instructor. 3 hours.
209. **Honors Course in Computer Science.** Prerequisite: Computer Science 101 or 121; registration in Computer Science 201 or 294; consent of instructor. 1 hour.
287. **Introduction to Numerical Analysis.** Same as Mathematics 287. Presents basic, introductory material and concepts. Topics include computer representation of numbers; error analysis; iterative methods; solution of linear equations. The computer is used extensively. A project is assigned. Prerequisite: Computer Science 101 or 121, one year of calculus, or consent of instructor. 3 hours.
290. **Individual Study.** Prerequisite: Computer Science 101 or 121; Computer Science 201 or 294; or consent of instructor. 1 or 2 hours.
293. **Introduction to Computer Hardware.** Introduction to computer devices and circuits for logic and memory. Lecture and demonstrations. Prerequisite: Computer Science 101, 103, or 121; Mathematics 142 or 143; or consent of instructor. 3 hours.
294. **Introduction to the Theory of Digital Machines.** Same as Electrical Engineering 294. An introduction to the general organization of computers. Number systems, Boolean algebra, the design of combinational circuits, and sequencing of arithmetic operations are discussed. Prerequisite: Junior standing in engineering or mathematics. 3 hours.
297. **Special Topics in Computer Science.** A lecture course in topics of current interest. Subjects are announced in the Time Table. Prerequisite: Consent of instructor. 2 to 4 hours.
301. **Formal Theory of Languages.** An introduction to mathematical models of programming languages and computation on a digital computer; phase structure languages, particularly context free languages, and their syntactic analysis with application to translation; abstract models of digital computers and the computations which they can perform subject to various restrictions on control, memory, and time; unsolvability results for computations and languages. Prerequisite: Computer Science 201, and senior standing or consent of instructor. 3 hours or 1 unit.
306. **Systems Programming.** The organization and structure of operating systems for various modes of computer use from simple batch systems to time-sharing/multi-processing systems is discussed. Prerequisite: Computer Science 201. 3 hours or 1 unit.
310. **Information Structures.** Lists, trees, and graphs; storage allocation; programming languages for manipulation of structures; applications of structures in text editing, syntactic analysis, graphic display, file structures, and information storage and retrieval. Prerequisite: Computer Science 201 or consent of instructor. 3 hours or 1 unit.
311. **Information Systems.** Organization of automatic systems for the recognition and retrieval of information; data base description, pattern recognition; including computer-aided diagnosis; and an introduction to formal cognitive systems; specifically to artificial

- intelligence and heuristic programming. Prerequisite: Computer Science 310. 3 hours or 1 unit.
313. **Combinatorial Mathematics.** Same as Mathematics 313. Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, block designs. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
357. **Computer-Assisted Instruction.** Same as Secondary and Continuing Education 357. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons. Among the topics treated are instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Computer Science 107 or equivalent, or consent of instructor. 4 hours or 1 unit.
365. **Digital Computer Methods for Statistical Data Processing.** Same as Agronomy 365. A study of computing methods for efficient utilization of high-speed equipment in the processing of statistical data. Emphasis is on principles of application of computing equipment to the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: Computer Science 101, 103, 107, or 121, and a course in statistics or statistical methods or equivalent, or consent of instructor. 3 hours or 1 unit.
367. **Computer Application to Problems in Mathematics.** Same as Mathematics 367. Discusses many problems which can be formulated mathematically and lend themselves to computer solution. Problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; game playing and decision problems. Prerequisite: Computer Science 101, 107, 121, or equivalent and junior standing, or consent of instructor. 3 hours or 1 unit.
375. **Automata and Formal Languages, I.** Same as Mathematics 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; the Post correspondence problem and its application to context-free languages. Prerequisite: Computer Science 319 or consent of instructor. 3 hours or 1 unit.
376. **Automata and Formal Languages, II.** Continuation of topics in Computer Science 375. Context sensitive languages and linear bounded automata; operations on languages, closure properties, abstract families of languages; miscellaneous unsolvable problems; time and tape bounded Turing machines; other topics chosen by the instructor. Prerequisite: Computer Science 375. 3 hours or 1 unit.
383. **Linear Programming.** Same as Mathematics 383. Systems of linear inequalities, the standard canonical and general linear problems, simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
385. **Theory of Semiconductor Computer Devices.** Same as Electrical Engineering 385. Crystal conduction; large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology; masking, oxidizing, and etching. Emphasis on development of device-theoretical background for computer logic design. Prerequisite: Computer Science 294 and senior standing, or consent of instructor. 3 hours, or 3/4 or 1 unit.
387. **Numerical Analysis.** Same as Mathematics 387. Error analysis and algorithms for: the solution of equations; the computation of eigenvalues and eigenvectors; numerical quadrature; numerical approximation of functions. Prerequisite: Computer Science 287, a knowledge of elementary matrix algebra, or consent of instructor. 3 hours or 1 unit.
389. **Combinatorial Computing.** Computational aspects of algorithms for solving combinatorial problems. Topics include counting and enumeration, sorting, searching, computational problems in graph theory and algebra. Prerequisite: Computer Science 121 or equivalent and Mathematics 315 or equivalent, or consent of instructor. 3 hours or 1 unit.

391. **Switching Theory.** Same as Electrical Engineering and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; pulse-mode and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Introduction to Automata Theory.** Same as Electrical Engineering and Mathematics 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Computer Science 391 or consent of instructor. 3 hours, or 1/2 or 1 unit.
393. **Digital Computer Circuit Design.** Same as Electrical Engineering 393. Design of switching circuits and systems, taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data handling links. Component tolerance, circuit reliability, and cost factors are considered. Prerequisite: Electrical Engineering 342 and Computer Science 294 or 391, or consent of instructor. 3 hours or 1 unit.
394. **Logical Design of Automatic Digital Computer Circuits.** Same as Electrical Engineering 394. A course in the design of automatic digital computers. Major emphasis is on logical structure of components and the interrelations necessary for automatic operation. Prerequisite: Computer Science 294 and senior standing, or consent of instructor. 3 hours or 1 unit.
397. **Special Topics in Computer Science.** A lecture course in topics of current interest. Subjects are announced in the Time Table. Prerequisite: Consent of instructor. 2 to 3 hours, or 1/2 to 1 unit.
400. **Introduction to Automatic Digital Computing for Graduate Students.** A beginning course covering the programming of digital computers using procedure oriented language. No graduate credit.
401. **Compiler Construction.** Compiler structure; lexical analysis, syntax analysis, grammars, description of programming languages, automatically constructed recognizers, error recovery; semantic analysis, semantic languages, semantic processes, intermediate language, optimization techniques, extendible compilers. 1 unit. Prerequisite: Computer Science 301 and 310.
413. **Computer Applications in Social Science Statistical Research.** Same as Psychology and Sociology 413. Computer procedures for the analysis of sociological and psychological data, including probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. 1 unit. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387.
414. **Engineering Applications of Linear Graphs.** Same as Electrical Engineering 414. Elementary theory of linear graphs, Euler graphs; incidence, cut-set and circuit matrices and their properties; realizability of cut-set, circuit and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; communication networks. 1 unit. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318.
441. **Computer Systems Analysis.** Analytical tools are developed for modeling and analysis of real time computer systems. Techniques include queueing theory, scheduling theory, and operations research methods. 1 unit. Prerequisite: Mathematics 361 or 363 or equivalent.
443. **Integer Programming and Advanced Linear Programming.** Algorithms of integer programming are discussed along with their computational implementations. A self-contained discussion of linear programming is given as preliminary for Gomory's algorithm for integer programming. Applications of integer programming are also presented. 1 unit. Prerequisite: Mathematics 315 or equivalent.
456. **Coding Theory.** Same as Electrical Engineering 456. General discussion on coding

- theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; applications to computers and data transmission systems. 1 unit. Prerequisite: Mathematics 317 or equivalent, or consent of instructor.
457. **Advanced Numerical Analysis.** Same as Mathematics 457. Ordinary differential equations; existence theory of Picard, one-step and multi-step methods, discretization error, convergence, stability, boundary value problems; integral equations. 1 unit. Prerequisite: Computer Science or Mathematics 387, or consent of instructor.
458. **Numerical Solution of Partial Differential Equations.** Same as Mathematics 458. The numerical solution of initial and boundary value problems for partial differential equations; topics include the approximation of differential operators by difference operators, the solution of large systems of linear equations by iterative methods, and discussion of convergence and numerical stability. 1 unit. Prerequisite: Computer Science or Mathematics 457, or consent of instructor.
463. **Information Theory.** Same as Electrical Engineering and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. 1 unit. Prerequisite: Mathematics 361 or equivalent.
465. **Topics in Automata Theory.** Same as Electrical Engineering and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. 1 unit. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 392, or consent of instructor.
481. **Threshold Logic.** Same as Electrical Engineering 481. Mathematical model of computer elements which work under threshold or majority principle; mathematical theory of threshold functions; realizability using a linear programming approach; network syntheses of majority principle devices. 1 unit. Prerequisite: Consent of instructor.
482. **Theory of Digital Computer Arithmetic.** Same as Electrical Engineering 482. This course emphasizes the use of redundancy in the representation of digits in order to increase the efficiency of computer arithmetic. Topics include multiplier recoding, division with redundantly represented quotients, and structural redundancy as implied by carry-save and signed-digit techniques. 1 unit. Computer Science or Electrical Engineering 394.
485. **Advanced Theory of Magnetic and Optic Computer Memory Devices.** Same as Electrical Engineering 485. Theory of ferromagnetism and superconductivity applied to memory devices; light propagation in anisotropic media; modulators and deflectors; principles of laser operation. 1 unit. Prerequisite: Computer Science or Electrical Engineering 385.
487. **Theory of Approximation.** Same as Mathematics 487. General approximation theory in normed linear spaces with primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Chebyshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants, as approximants; use of approximations in computing. 1 unit. Prerequisite: Mathematics 318, 348, or consent of instructor.
490. **Individual Study.** Individual study or reading in a subject not covered in normal course offerings. 1/2 to 2 units. Prerequisite: Consent of instructor.
491. **Seminar in Computer Science.** Seminar on topics of current interest. Subjects are announced in the Time Table. 1/2 to 1 unit. Prerequisite: Consent of instructor.
497. **Special Topics in Computer Science.** Lecture course in topics of current interest. Subjects are announced in the Time Table. 1/2 to 1 unit. Prerequisite: Consent of instructor.
499. **Thesis Research.** Section A, for master's degree candidates; Section B, for doctoral degree candidates. 0 to 4 units. Prerequisite: Consent of instructor.

Czech

(See Slavic languages and Literatures)

DAIRY SCIENCE

Head of Department: Professor K. E. HARSHBARGER

Department Office: 315 Animal Sciences Laboratory

- 100. Introduction to Dairy Production.** Survey of industry; breeds of dairy cattle; selection, feeding, and management of herds. Lecture, quiz, and laboratory. 3 hours.
- 110. Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours.
- 201. Livestock Management.** Same as Animal Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Dairy science and animal science majors do not receive credit for this course. Prerequisite: Dairy Science 221 or Animal Science 325. 5 hours.
- 204. Dairy Cattle Evaluation.** Relation of functional conformation, records, ancestry, age, environment, and individual traits as criteria which affect merit for milk production, breeding stock, and breeder acceptance. Prerequisite: Dairy Science 100 or consent of instructor. 3 hours.
- 205. Dairy Cattle Management.** The applied aspect of feeding, breeding, care, and management as they relate to the effective operation of a dairy farm enterprise. 3 hours.
- 221. Animal Nutrition.** Same as Animal Science 221. Principles of animal nutrition and their application to farm livestock and man. Prerequisite: Chemistry 102. 4 hours.
- 230. Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Animal Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104; one course in chemistry. 3 hours.
- 300. Special Problems.** Supervised research on any phase of dairy science, including bacteriology and microbiology, biochemistry, feeding and nutrition, genetics, and physiology. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or 1/2 to 1 unit. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval are required prior to advance enrollment and registration. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course.
- 305. Genetics and Animal Improvement.** Same as Animal Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Dairy Science 110 or equivalent. 3 hours or 3/4 unit (summer session, 1/2 unit).
- 320. Nutrition and Digestive Physiology of Ruminants.** Same as Animal Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Dairy Science 221. 3 hours or 3/4 unit.
- 330. Reproduction and Artificial Insemination of Farm Animals.** Same as Animal Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science 100 or Animal Science 100. 3 hours or 3/4 unit (four-week summer session, 1/2 unit.)
- 334. Marketing Dairy Products.** Same as Agricultural Economics 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, mark-up laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; expanding markets for dairy products. Inspection trip; estimated cost, \$5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or twelve hours of dairy science or dairy technology. 3 hours, or 3/4 or 1 unit.

340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, and 112, or equivalent. 4 hours or 3/4 unit.
350. **World Animal Agriculture.** Same as Animal Science 350. Survey and interpretations of the role of animal agriculture in various cultures of the world and particular references to underdeveloped countries of the world. The importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people is discussed. Prerequisite: Consent of instructor. 3 hours or 3/4 unit.
402. **The Microbiology and Physiology of Ruminant Nutrition.** The physiological and microbiological aspects of ruminant digestion and their influence on the metabolism of the extraruminal tissues; interpretation of nutritive requirements in terms of rumen microbial activities and evaluation of research techniques. Prerequisite: Biochemistry 350 or equivalent. 3/4 unit.
408. **Physiology of Lactation.** The anatomy and endocrinology of mammary development; the environmental, endocrinological, and biochemical factors which affect the yield and composition of milk. 1/2 to 2 units.
412. **Advanced Endocrinology.** Same as Animal Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Consent of instructor. 1/2 unit. This course may be repeated for credit not to exceed a total of 2 units.
415. **Advanced Animal Genetics.** Same as Animal Science 415. Genetic theory, analysis of animal breeding problems, genetic results of selection, and different system of breeding. Prerequisite: Dairy Science 305 or equivalent. 1 unit.
416. **Population Genetics and Animal Breeding.** Same as Animal Science 416. The mathematical theory of population genetics and its application to the improvement of farm animals; results of different systems of mating and the expected gains from different methods of selection. Prerequisite: Dairy Science 110 or equivalent. A knowledge of elementary algebra is essential. 1 unit.
430. **Physiology of Mammalian Germ Cells.** A literature and laboratory course covering the recent theories and developments on the formation, transportation, and livability of spermatozoa and ova within the body, and their metabolism and preservation *in vitro*. Prerequisite: Dairy Science 330, Animal Science 406, and Biochemistry 350 or equivalent, or consent of instructor. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Dairy Science 340 or equivalent. 3/4 unit.
450. **Dairy Bacteriology.** Assigned laboratory problems in dairy bacteriology. Prerequisite: Ten hours of advanced microbiology and/or chemistry; consent of instructor. 1/2 to 2 units.
481. **Animal Biochemical Laboratory Techniques.** Same as Animal Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences. Isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; determination of metabolic pathways and processes. Prerequisite: Biochemistry 350 and 355; consent of instructor. 1 unit.
490. **Dairy Science Seminar.** Discussions of current research and literature. Registration for 0 or 1/2 unit every semester is required for graduate students majoring in dairy science. 0 or 1/2 unit.

493. **Special Problems.** Individual investigation in any phase of dairy science. 1/2 to 2 units.
 499. **Thesis Research.** 0 to 4 units.

DANCE

Head of Department: Professor O. J. KOSTOCK

Department Office: 4-305 Krannert Center for the Performing Arts

101. **Beginning Modern Dance.** An introduction to basic dance technique and movement improvisation. Includes the study of motion as an art, group relationships in improvisation, and discussion of choreographic ideas. For non-dance majors. 1 hour. May be repeated for 1 additional hour.
102. **Intermediate Modern Dance.** Intermediate dance technique and improvisation. For non-dance majors. Prerequisite: Dance 101 or consent of instructor. 1 hour. May be repeated for 1 additional hour.
150. **Orientation to Dance.** Orientation to the field of dance and its place in education. Includes general dance history, history of modern dance movement, philosophy of dance, discussion of theories and problems involved in dance education. Students in the curriculum in the teaching of dance are required to enroll in Secondary and Continuing Education 101, dance section. 2 hours.
160. **Beginning Technique.** Beginning modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
162. **Improvisation, I.** Experience in selective and basic processes of movement involvement, both individual and group. Special attention is paid to organic and economical use of movement, the dynamics and quality of which are necessary to the activity being performed. 1 hour.
163. **Improvisation, II.** Continuation of Dance 162, with emphasis on expanding bodily activity into various existing or created performing environments, composed of sound, lights, and costumes. Special attention is given to expanding audience-performer relationships, to audio-visual effects, and to collaborative work with musicians, designers, and technicians in these related areas. Prerequisite: Dance 162 or consent of instructor. 1 hour.
164. **Beginning Composition.** Theory and practice in principles of dance composition. Emphasis is placed on solo creative work using various approaches to composition. Prerequisite: Dance 163 or consent of instructor. 2 hours.
165. **Intermediate Technique.** Intermediate modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. Prerequisite: Dance 160 or consent of instructor. 3 hours (summer session, 2 hours). May be repeated to a maximum of 12 hours.
166. **Beginning Ballet, I.** Prerequisite: Dance 160 or consent of instructor. 1 hour. May be repeated once for credit.
167. **Beginning Ballet, II.** Prerequisite: Dance 166 or consent of instructor. 1 hour. May be repeated once for credit.
168. **Music Theory and Practice for Dance, I.** The analysis and organization of movement and music in terms of its rhythmic components, time and force. 2 hours.
169. **Music Theory and Practice for Dance, II.** A progressive continuation of Dance 168, with emphasis on music theory, rhythmic awareness, and interpretation of melodic material; theory and practice in accompanying dance classes; familiarity with existing music for the dance. Prerequisite: Dance 168 or consent of instructor. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

243. **Creative Dance for Children.** Theory and method of teaching dance to children. Supervised practical teaching experience with first through eighth grade children. Prerequisite: Dance 163 and 165, or consent of instructor. 3 hours.
244. **Teaching of Dance.** Theory and practice in methods of teaching dance at the high school level, including lesson planning and curriculum construction. Students in the curriculum in the teaching of dance are required to enroll in Secondary and Continuing Education 241. Prerequisite: Dance 243 or consent of instructor. 3 hours.
245. **Dance in the Elementary School.** Theory and practice in methods of teaching dance in the elementary school. Practical experience in observation and teaching within an elementary school system. Prerequisite: Dance 243. 2 hours.
260. **Advanced Technique, I.** Advanced modern dance technique. Prerequisite: Dance 165 or consent of instructor. 3 hours (summer session, 2 hours). May be repeated to a maximum of 12 hours.
264. **Intermediate Composition.** Experience in choreographing a minimum of one solo and two group works utilizing various approaches to choreographic form. Prerequisite: Dance 164 or consent of instructor. 2 hours.
266. **Intermediate Ballet, I.** Prerequisite: Dance 166 or consent of instructor. 1 hours. May be repeated once for credit.
267. **Intermediate Ballet, II.** Prerequisite: Dance 266 or consent of instructor. 1 hour.
340. **History of Dance, I.** A survey course tracing dance from its beginnings in primitive societies through the nineteenth century. Prerequisite: Consent of instructor. 3 hours, or 3/4 to 1 unit.
341. **History of Dance, II.** A survey course tracing the development of dance in the twentieth century. Prerequisite: Dance 340; consent of instructor. 3 hours, or 3/4 to 1 unit.
345. **Dance Production Workshop.** Experience in choreography and production of group compositions with special emphasis on staging, lighting, and costuming. Prerequisite: Dance 264 or consent of instructor. 3 hours, or 3/4 to 1 unit.
346. **Theory and Philosophy of Dance.** A study of the relationship of aesthetic principles and dance theory to a philosophy of dance in education and of dance as a performing art. Prerequisite: Dance 340 or consent of instructor. 3 hours, or 3/4 to 1 unit.
350. **Dance Repertory Workshop.** Experience in learning, rehearsing, and perfecting concert dance pieces under the direction of experienced choreographers. Prerequisite: Enrollment in advanced technique course; consent of instructor. 2 or 4 hours, or 1/2 or 1 unit. May be repeated to a maximum of 12 hours or 2 units.
351. **Special Problems.** Special projects in research or creative investigation taught on an individual basis. Prerequisite: Junior standing; consent of instructor. 2 to 4 hours, or 1/2 or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
360. **Advanced Technique, II.** Advanced modern dance technique. Prerequisite: Dance 260 or consent of instructor. 3 hours or 1/2 unit (summer session, 2 hours or 1/4 unit). May be repeated to a maximum of 12 hours or 2 units.
365. **Advanced Composition.** Work in advanced composition for the experienced student choreographer, including performance of at least one work. Prerequisite: Dance 264 or consent of instructor. 2 hours or 1/2 unit.
400. **Problems in Dance Education.** Basic historical, philosophical, and scientific foundations and developments in dance education; teaching methods; development of compositional problems; creative methods of instruction; organizational problems of dance groups and public dance performance. Prerequisite: Dance 243 or 244, or equivalent. 1 unit.
401. **Choreography.** Experience in choreographing a minimum of one solo and one group composition to be presented at the end of the semester. Prerequisite: Dance 345 or equivalent. Students may reregister for a maximum of two units with the permission of the head of the department. 1/2 to 2 units.
490. **Dance Seminar.** Student presentation of thesis reports in dance; informal discussions, demonstrations, lectures, and critical analysis of current problems in dance by professional guests. 0 credit.

499. **Thesis Research.** Preparation of theses in dance. 1/2 to 2 units.

ECONOMICS

Chairman of Department: Professor J. F. DUE

Department Office: 330 Commerce Building (West)

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in economics, including Economics 108, or 102 and 103, 171, 300, and 301. Students are advised to take one of the following mathematics sequences; Mathematics 120, 130, 140; or Mathematics 120, 131, 141; or Mathematics 135, 145. Minimum requirements of the department can be satisfied by Mathematics 120, 130; or Mathematics 120, 131; or Mathematics 135; or Mathematics 124, 134. In addition, students considering graduate work should take Mathematics 315. Liberal arts majors are strongly advised to elect Accountancy 201, which is not acceptable toward the major requirement.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, education, finance, geography, geology, history, law, mathematics, philosophy, political science, psychology, social work, and sociology. An economics major who chooses finance as a minor must include twelve hours in a second minor. The curriculum in Latin-American and Asian studies or in Russian language and area studies is also accepted as a minor.

Note: Economics 102 and 103 are required for all commerce students, and these courses or Economics 108 are required for all liberal arts majors in economics. Students who expect to do advanced work in economics should take these courses in their sophomore year.

102. **Principles of Economics, I.** An introduction to monetary theory, national income theory, growth theory; public policy in the areas of economic stability and growth; historical development of the American economy; population problems. Prerequisite: One semester of college work. 3 hours.
103. **Principles of Economics, II.** An introduction to the theory of product prices, the theory of the firm under varying conditions of competition and monopoly, and productive resource pricing, international economics, regional economics, and related public policy questions in these areas. Prerequisite: Economics 102. 3 hours. SCHOEPLEIN and others.
108. **Elements of Economics.** A general survey of the operation of the economic system, with reference to the business firm, the determination of price and output, the level of national income and the general price level, the monetary and banking system, public finance, labor relations, and international trade. For non-commerce students only. Prerequisite: First-semester freshman in engineering; second-semester freshman in other colleges. Not open to students who have had Economics 102 and 103. 3 hours. One additional hour of credit is received if a student enrolls in Economics 109. PADEN and others.
109. **Current Economic Problems.** An economic analysis of specific economic problems dealing with poverty, economic development, international economics, and other contemporary issues. Prerequisite: Registration in Economics 108. 1 hour.
171. **Introductory Economic Statistics.** An introduction to statistical methods as applied in economics and other social sciences. Topics covered are descriptive statistics, hypothesis testing and estimation including contingency tables, linear statistical models, and classical time series. For non-commerce students only. Students may not receive credit for Economics 171 in addition to Economics 172 and 173, Mathematics 161, or Psychology 135. Prerequisite: Registration in Mathematics 134. 3 hours.
172. **Economic Statistics, I.** An introduction to the modern theory and methodology of statistics in the areas of economics and business. The choice of "best" alternatives under conditions of uncertainty; frequency distributions and probability, the payoff table, and expected values as decision criteria; the cost of uncertainty and of irrationality; the use

- of new information; marginal, joint, and conditional probabilities; sample design and statistical inference. Prerequisite: Mathematics 134 or equivalent; credit or registration in Economics 102 or 108. 3 hours.
173. **Economic Statistics, II.** Continuation of Economics 172. Methods of estimation of basic parameters in linear models are emphasized; growth curves, simple and multiple regressions and correlation; linear combinations of ratios and percentages; index numbers, their construction and use; hypothesis testing and linear functions; contingency tables, and variance analysis. Prerequisite: Economics 172 or equivalent. 3 hours.
195. **Freshman Honors Seminar.** A seminar on selected topics of current interest in economics. Open to freshman James Scholars only. 3 hours.
196. **Honors Seminar.** A seminar on selected topics of current interest in economics. Open to freshman and sophomore James Scholars only. Prerequisite: Economics 108. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
214. **Government Finance and Taxation.** A general survey of government finance at the federal, state, and local levels, including government expenditures, principles of taxation, intergovernmental fiscal relations, public borrowing, debt management, and fiscal policy for economic stabilization. Prerequisite: Economics 103 or 108. 3 hours. DUE.
236. **American Economic History.** Westward movement; growth of industry, agriculture, commerce, finance, transportation, trust movement, and labor since 1790. Prerequisite: Economics 103 or 108; junior standing. 3 hours. KEMMERER and others.
238. **European Economic History.** Economic structure and development of Europe since 1000 with respect to agriculture, industry, trade, technology, finance, and government. Emphasis is given to those forces which contribute to the economic development of Europe and to the spread of these forces throughout the world. Prerequisite: Economics 103 or 108. 3 hours. NEAL.
240. **Labor Problems.** A survey of the nature and causes of the problems of the American wage earner; economic insecurity, wages, hours, substandard workers, and the efforts of wage earners and society through organization and legislation to solve these problems. Prerequisite: Economics 103 or 108. 3 hours.
255. **Comparative Economic Systems.** An analysis of the significant similarities and differences in the development, the structure, and policies of capitalism, communism, and market socialism. Prerequisite: Economics 103 or 108. 3 hours. GOTTHEIL, MILLAR, SCHRAN, FERBER.
272. **Introduction to Econometrics.** The use of models in the study of economic relations, single equation least squares, analysis of variance, and multi-equation models. Prerequisite: Economics 173 and Mathematics 134. 3 hours.
288. **Government Regulation of Economic Activity.** Analysis of the economic bases, policies, and consequences of government regulation of economic activity. Economic patterns of regulation are studied in selected areas. Prerequisite: Economics 103 or 108. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in economics. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours. HEINS.
295. **Senior Research.** A research and readings course for students majoring in economics. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours. HEINS.
300. **Intermediate Micro-Economic Theory.** Micro-economic analysis including value and distribution theory. Topics include the analysis of demand, the theory of the firm and the industry, and the analysis of the pricing of the factors of production. Each topic is integrated in a micro-general equilibrium context which builds towards explaining the resource allocation process. Students may not receive graduate credit for both Economics 300 and Business Administration 500. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 3/4 unit. Upon recommendation by his adviser and approval by the Department

of Economics, a non-economics major may receive up to 3/4 unit. Graduate credit for both Economics 300 and 400 is given only upon recommendation of the student's adviser and approval by the Department of Economics.

301. **Intermediate Macro-Economic Theory.** The modern theory of the determination of the level and rate of growth of income, employment, output, and the price level. Alternate fiscal and monetary policies to facilitate full employment and economic growth are discussed. Students may not receive credit for both Economics 301 and Business Administration 501. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 3/4 unit. Upon recommendation by his adviser and approval by the Department of Economics, a non-economics major may receive up to 3/4 unit. Graduate credit for both Economics 301 and 401 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
302. **Economic Analysis.** An introduction to the theory of income and employment, price and allocation, and instability and growth. Prerequisite: Economics 108, enrollment in National Science Foundation Summer Institute in Economics, or consent of instructor. 3 hours, or 1/2 or 1 unit. Offered in the summer session only. PADEN.
306. **History of Economic Thought.** A study of the development of economics. Contributions of individual writers and schools of thought are examined in their setting and as they influenced economic thought and national policy. Prerequisite: Economics 103 or 108; senior standing. 3 hours or 1/2 unit.
312. **Economic Dynamics and Growth.** An analysis of the causes of economic instability, the requirements for economic growth in the national economy, and a consideration of public policy relating to instability and growth. Prerequisite: Economics 103 or 108; Economics 301. 3 hours, or 1/2 or 1 unit. FRANKEL and others.
313. **Economics of Consumption.** Same as Home Economics 313. An analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or 3/4 or 1 unit. DUNSING.
315. **The Economics of Poverty and Income Maintenance.** Same as Labor and Industrial Relations 315. An economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit. HUSBY, PARRISH.
328. **International Economics.** An introduction to the theory of international trade and finance with selected application to current problems of commercial policy, balance of payments adjustment, and the international monetary system. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit. BECKETT, GILLESPIE, YEUNG.
329. **Contemporary Issues in the International Economy.** Analysis in depth of selected current issues and policy problems of the international economy. The topics may include but are not restricted to the following: new approaches to the theory of international trade, reform of the international monetary system, role of the General Agreement on Tariffs and Trade and United Nations Conference on Trade and Development in expanding trade between developed and undeveloped economies, problems of stabilizing international commodity markets, balance of payments problems of the United States and other selected countries. Prerequisite: Economics 328 or equivalent. 3 hours, or 1/2 or 1 unit. STAFF.
335. **American Financial History.** American monetary history and the development of the present monetary system; the rise of commercial, investment, and central banking and of other financial institutions; and the financing of government, especially of major wars. Prerequisite: Finance 150. 3 hours, or 1/2 or 1 unit. KEMMERER and others.
337. **Economic History of American Agriculture.** Same as Agricultural Economics and History 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college-level course in basic economics or American history. Graduate students who take this course for 1 unit credit are required to do extra work; the student writes a scholarly paper on some approved topic in agricultural history. 3 hours, or 3/4 or 1 unit. GUITHER.

341. **The Economics of Labor Markets.** Same as Labor and Industrial Relations 341. A study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems. Topics include determinants of inter-industry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
343. **Unions, Bargaining, and Public Policy.** Same as Labor and Industrial Relations 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States. Includes theory of the labor movement; process of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
345. **Economics of Manpower.** Same as Labor and Industrial Relations 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; private industry and union manpower planning. Graduate credit is not given for both Economics 345 and 444. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
349. **Senior Seminar in Labor Economics.** Preprofessional capstone course intended to unify other courses in labor economics and closely related fields. Included are studies of research techniques and sources; individual readings in current literature; preparation of research reports and papers; consideration of professional employment opportunities and graduate study in labor economics and industrial relations. Prerequisite: Economics 240; consent of instructor. 3 hours, or 1/2 or 1 unit.
350. **The Developing Economies.** An analysis of the economic problems associated with newly developing nations. Emphasis is placed on a study of their economic structures, their factor scarcities, and their programs for development. Not open for graduate credit for graduate candidates in economics. Graduate credit is not given for both Economics 350 and Economics 450 or 451. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 to 1 unit.
352. **Economic Development in Latin America.** Same as Agricultural Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit.
353. **Economic Development in India and Southeast Asia.** Same as Agricultural Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit. HERDT.
354. **Economic Development of Tropical Africa.** Same as Agricultural Economics 354. Types of African economies and growth of the exchange economy; development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental planning, and development projects; demographic, land tenure, and institutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit. DUE.
357. **The Soviet Economy.** Analytical survey of Soviet economic development; structure and performance of the economy; problems of planning and control. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit. GOTTHEIL, HODGMAN, MILLAR.
358. **The Economy of China.** Discussion of changes in the patterns of production, exchange, and distribution in Communist China, with emphasis on their relation to social transformation. Survey of Chinese economic history over the past century, dealing with the institutional background to and the structure of economic activities in China. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or 1/2 or 1 unit. SCHRAN.

- 360. Regional Economic Development.** A survey of the theory and problems of regional economic development, including regional accounts, interregional income and trade theory, principles of the location of economic activity, theories of regional growth, and public policy for development of regions. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit. WILLIAMSON, PARKER.
- 361. The Urban Public Economy.** An economic analysis of public safety with respect to urban problems. A full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land use controls, pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or 1/2 or 1 unit.
- 367. Mathematical Economics, I.** Mathematical reformulation and interpretation of traditional economic theory. Prerequisite: Mathematics 141 and Economics 300 and 301, or equivalent. 3 hours, or 1/2 to 1 unit.
- 368. Mathematical Economics, II.** Introduction to linear and nonlinear economic models. Emphasis is placed on the formulation and interpretation of modern economic theory and welfare economics. Prerequisite: Mathematics 124 or 315; Mathematics 141; Economics 300 or equivalent. 3 hours, or 1/2 to 1 unit.
- 375. National Income and Business Forecasting.** Same as Business Administration 375. The significance of national income and related economic accounts for analysis and forecasting of business conditions. Develops the interrelations between data systems used by government agencies and business concerns in program planning and current decision making. The use of models for solving problems in this area is introduced. Prerequisite: Economics 103 or 108; Economics 171. 3 hours, or 1/2 or 1 unit.
- 384. Economics of Transportation.** Economic aspects of the transportation industry with special emphasis on problems of regulation and public policy. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
- 386. Current Transportation Problems.** An analytical and critical study of selected problems of current interest in transportation. Prerequisite: Economics 384 or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 389. Industrial Competition and Monopoly.** The organization and tactics of market control, the development of antitrust law and policy, public policy regarding competitive practices, special policies applying to natural resource industries, and regulated monopoly and government ownership as alternatives to the antitrust approach. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
- 400. General Economic Theory.** Emphasis in this course is placed on micro-economic theory. The principal topics include: a review of value and distribution theory, the theory of choice by household and firms, general micro-economic theory; and theoretical developments of current interest. Attention is given to empirical studies intended to affirm or disaffirm economic principles. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 400 and Business Administration 500. Prerequisite: Economics 102, 103, or 108. 1 unit. Graduate credit for both Economics 400 and 300 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
- 401. General Economic Theory.** Emphasis in this course is placed on macro-economic theory and the relationship of economics to the other social sciences. The principle topics include: a review of Keynesian macro-economic theory, formal growth theory, selected business cycle theory, the theory of socio-economic change, and an outline of the differentiation and integration of economics and other social sciences. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 401 and Business Administration 501. Prerequisite: Economics 102, 103, or 108. 1 unit. Graduate credit for both Economics 401 and 301 is given only upon recommendation of the student's adviser and approval by the Department of Economics.

402. **Economic Theory.** This course develops modern micro-economic theory: utility functions and demand; production functions and cost; linear programming; price and nonprice policy by the firm; market equilibria; income distribution; general equilibrium including input-output analysis. The course is given in two sections, one offering a primarily mathematical presentation, the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics. For mathematical section, a knowledge of algebra and calculus. 1 unit.
403. **Economic Theory.** This course develops modern macro-economic theory; the Keynesian model of employment, interest, and money; its extension to international trade; fiscal policy and macro-economic theory of distribution; the consumption function; the theory of growth and cycles in terms of difference and differential equations. This course is given in two sections, one offering a primarily mathematical presentation, the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics. For mathematical section, a knowledge of algebra and calculus. 1 unit.
406. **History of Economic Thought.** An analysis of economic thought from the Physiocrats to the present; the materials selected are evaluated both as reflections of their times and as contributions to contemporary economic thought. Prerequisite: Economics 300 and 301, or equivalent. 1 unit. BRANDIS.
408. **Philosophical Problems in Economics.** The study of philosophical problems in economics, with some emphasis on the methodology and epistemology of economic theory. The views of leading economists are used to show the development of broad philosophical problems of economic theory, the relation of theory and certain of its applied areas, and the relation of economics to other selected disciplines. These problems are treated in the light of modern scientific philosophy. Prerequisite: One unit either in economic theory or in the history of economic thought. 1 unit.
409. **Marxian Economics.** Analysis of Marx's economic theory and predictions. The seminar concentrates on a critical evaluation of Marx's economic theory, a survey of contributions to the theory since Marx, and a Marxist evaluation of the neo-classical synthesis. Prerequisite: Economics 300 and 301, or consent of instructor. 1 unit.
410. **Price and Distribution Theory.** A research-oriented seminar in micro-economic theory. Major topics treated include comparative static analysis of demand, production, and the theory of markets; dynamic equilibrium; market dynamics. Subtopics include axiomatics of preferences; ordinal and Bernoullian utility, revealed preference, and the interdependence of preferences; multiperiod production, utility, and consumption; the aggregation of micro-economic relationships; expectations and response lags; analysis of changing market structures; game theory. Prerequisite: Economics 402 and 470, or equivalent. 1 unit.
411. **Capital and Interest Theory.** A comprehensive and critical examination of the theory of capital and interest as the subject has been developed by the leading English and continental writers. Special attention is given to the optimal investment decision of the firm, capital accumulation and the efficient utilization of society's resources, and to the relation between capital and interest. 1 unit. Prerequisite: Economics 403 or consent of instructor. BREMS, SPRENKLE, WELLS.
412. **Advanced Aggregate Income Theory.** An analysis of the theory of income and employment with emphasis upon the measurement of income and product, money flows, and the relationship between input and output in the economy. Prerequisite: Economics 403 or consent of instructor. 1 unit. BREMS, PADEN, WELLS.
413. **Consumption Theory.** The theory of consumer behavior in modern economic analysis. Utility analysis at the micro level, consumer interdependence and problems of aggregation, econometric tests, aggregate consumption analysis in static and dynamic contexts, and the implications of the theory of consumer behavior for cyclical movements and economic growth. Prerequisite: Economics 400 or 402, or consent of instructor. 1 unit. FERBER, MCMAHON.
414. **Public Finance.** Analysis of government expenditures and decision making; the budge-

tary process; fiscal policy; government borrowing and debt management; intergovernmental fiscal relations; pricing of government services; public finance in developing economies. Prerequisite: Six hours of economics. 1 unit. DUE, HEINS, LEUTHOLD.

- 415. Economics of Taxation.** Principles of taxation; incidence and distribution of tax burden; economic analysis of the major taxes; the personal and corporate income taxes, sales and excise taxes; property tax, and others; taxation and economic development. Prerequisite: Six hours of economics. 1 unit. DUE, HEINS, LEUTHOLD.

- 420. Monetary Theory.** A critical examination of monetary theories and their neo-classical antecedents. Among the topics considered are the quantity theory, liquidity preference, the demand for money, velocity, theories of the level and term structure of interest rates, asset theory, and money in static and dynamic macro-general equilibrium models. Prerequisite: A course in income and employment theory or consent of instructor. 1 unit. HODGMAN, SPRENKLE.

- 421. The Theory of Monetary Policy.** Theories of central banking, debt management, financial intermediaries, and the monetary behavior of firms and households are used to explore current issues in the theory of monetary policy. Current empirical research is reviewed with particular emphasis on econometric studies of monetary behavior. Prerequisite: A course in money and banking, in macro-economic theory, calculus, and statistics, or consent of instructor. 1 unit. HODGMAN, SPRENKLE.

- 425. Macro-Accounting.** Same as Accountancy 455. An examination of the fundamental concepts underlying the attempt to measure the economic activities of macro-units; similarities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macro-accounting statements and analyses; usefulness of macro-accounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macro-accounting theory or consent of instructor. 1 unit.

- 428. International Trade Theory.** The neoclassical theory of international trade is developed and then used for the analysis of tariffs, customs, unions, and the effects of trade on the distribution of income and welfare. The relations between the balance of payments and national income are analyzed and used to study the role of income changes combined with price changes in the balance of payments adjustment process. Prerequisite: Economics 300 or 301, or equivalent. 1 unit. GILLESPIE, WEISER.

- 429. International Trade Policy.** Concepts of balance of payments equilibrium, the foreign exchange market and the theory of capital movements; current problems and policies related to balance of payments disequilibrium, trade policy, and the functioning of the international monetary system. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.

- 436. American Economic History.** Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organizations, capital growth, money and banking, foreign and domestic commerce, and social progress. Material chiefly since 1790. Not open to students who have had Economics 236. 1 unit. KEMMERER.

- 438. Economic History of Europe.** The major lines of development since 1450; comparative study of forces and institutions inimical or favorable to growth; selected readings on organization of economic activity, role of governments and the entrepreneur, commercial policy, monetary systems, land tenure, process of capital formation, industrialization, etc. Prerequisite: Consent of instructor. 1 unit. NEAL.

- 440. Labor Economics.** Same as Labor and Industrial Relations 440. A survey of recent trends in the labor force, a real and money earnings, and of the distribution of national income. This review of recent trends in these areas is used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.

- 441. Labor Economics.** Same as Labor and Industrial Relations 441. The economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free

- enterprise economy). Emphasis in all cases is upon the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
442. **Collective Bargaining.** Same as Labor and Industrial Relations 442. The development of a theory of the continuing interactions between unions and management which define and modify the role of each and the terms of employment. Appropriate social science concepts are used. Emphasis is on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority as well as on the interactions between the parties and governmental process. Graduate credit is not given for both Economics 343 and Economics or Labor and Industrial Relations 442. Prerequisite: Consent of instructor. 1 unit.
443. **Problems and Practices of Labor Dispute Settlement.** Same as Labor and Industrial Relations 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling, analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit. MCPHERSON.
444. **Economics of Manpower Resources.** Same as Labor and Industrial Relations 444. Emergence of the manpower resource issue; population as a resource base; the labor force; measurement and characteristics, behavior under changing income, employment, technology; women as the dynamic factor in labor force growth; problems of utilization of labor force components; intellectual resources, older workers, manual, white collar, Negro, marginal forces; issues of national manpower policy. Graduate credit is not given for both Economics 345 and 444. Prerequisite: Consent of instructor. 1 unit. PARRISH.
447. **Labor Union Organization and Administration.** Same as Labor and Industrial Relations 447. Analysis of the structure, functions, and government of the modern American trade union movement. Provides a survey of the environmental factors, objectives, and action programs with considerable emphasis on economic as well as internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit. GARMAN.
450. **The Economics of Development and Growth.** Review and analysis of the theories and patterns of growth in developed and underdeveloped economies. The problems and methods of measuring growth are considered, the variables thought to be strategic in the growth process are critically examined, and the policy implications of different theories are explored. Prerequisite: Economics 300 and 301, or equivalent. 1 unit. FRANKEL.
451. **The Developing Economies.** An analysis of the newly-developing economies, with emphasis on institutional factors affecting development, and economic policy relating to development. Prerequisite: Economics 450. 1 unit.
455. **Comparative Economic Systems.** A comparative analysis of the structures and policies of market-directed and planned economies. Prerequisite: Economics 103 or 108 or equivalent. 1 unit.
457. **Economic Planning in the Soviet Union and Eastern Europe.** An intensive examination of the structure and performance of the Soviet and the East European economies, emphasizing analysis of the main theoretic and operational dimensions of economic planning; choice, design, and efficacy of central planning instruments are evaluated from both theoretical and historical perspectives. Prerequisite: Economics 300 and 301, or 357, or consent of instructor. 1 unit. MILLAR.
460. **Location Theory.** The theory of location of economic activity in modern economic analysis. Production and location theories are synthesized and applied to regional structure and interregional and international trade and development. Graduate credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301, or equivalent. 1 unit. PARKER, WILLIAMSON.
461. **Urban and Regional Economic Development.** Measurement and analysis of interregional differences in economic growth. Graduate credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301. 1 unit. PARKER, WILLIAMSON.

467. **Mathematical Economics, I: Statics.** A study of quantitative techniques useful in economic analysis and decision making. Mathematical programming, input-output analysis, point-set theory and game theory, existence, optimality and stability conditions for static general equilibrium, activity analysis, including welfare economics. Prerequisite: Mathematics 315 and Economics 402 and 403, or equivalent. 1 unit.
468. **Mathematical Economics, II: Dynamics.** A study of quantitative techniques useful in economic analysis and decision making. Single and systems of difference and differential equations, dynamic programming, Pontryagin maximum principle, interaction of multiplier and accelerator, von Neumann model, Turnpike theorem, growth models, control systems. 1 unit. Prerequisite: Mathematics 315 and Economics 402 and 403, or equivalent.
470. **Economic Statistics.** Classical statistics and regression analysis; descriptive statistics, probability, point and interval estimation, decision theory, variance analysis, linear regression, and least squares estimates. Prerequisite: Consent of instructor. 1 unit. DUCHAN.
471. **Economic Statistics.** Part 1: the construction of econometric models; characteristics of models and choice of estimating methods; estimates of parameters by various methods. Part 2: Bayesian statistics and decision theory. Prerequisite: Economics 470 or equivalent. 1 unit.
476. **Econometrics, I.** Estimation of parameters for single equation models; tests of hypotheses and confidence regions for regression models; large sample theory in single equation models; Bayesian statistics in regression models. Prerequisite: Mathematics 315 and 363. 1 unit. JUDGE, RESEK, YANCEY.
477. **Econometrics, II.** Specification of models with systems of simultaneous equations; identification problem, distributed lag models, K-class estimators, maximum likelihood estimators, three-stage least squares, and effects of specification errors are considered. Prerequisite: Economics 476. 1 unit. JUDGE, RESEK, YANCEY.
479. **Research Seminar in Quantitative Economics.** Significant work in the area of quantitative economics is reported and explored by members of the instructional staff, by guest speakers from academic, governmental, and industrial centers, and by graduate students in the second year of their work who are assigned projects. Prerequisite: The equivalent of one year of graduate statistics (theoretical or applied), calculus, and the equivalent of one year of mathematical economics. 1 unit.
480. **Industrial Organization.** Theory of the organization of markets and firms, behavior of firms, functioning of competitive systems, performance of markets. 1 unit. ARNOULD.
481. **Industrial Organization and Public Policy.** The economic aspects of public policy relating to the maintenance of competition, public utility regulation, and natural resource regulation. A survey of other forms of regulation and market organization in other countries. Prerequisite: Economics 480. 1 unit. ARNOULD.
484. **Economics of Transportation, I.** A study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. 1 unit.
485. **Economics of Transportation, II.** A study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. 1 unit.
490. **Individual Study and Research.** Directed reading and research. 1/2 to 1 unit.
499. **Thesis Research.** Preparation of thesis required of all students writing master's or doctor's theses in economics. 0 to 4 units (summer session, 0 to 2 units). Master's theses, FLANDERS; doctor's theses, RESEK.

EDUCATION

100. **Education Practicum.** A laboratory course involving work in school and research projects of the instructor's choosing. For those who choose this option, it is taken in conjunction with Rhetoric 101 and 102 or Speech 111 and 112 and History and Philosophy of Education 201. 4 hours.
101. **Education Practicum.** Continuation of Education 100. Prerequisite: Education 100 or consent of instructor. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

Chairman of Department: Professor F. M. RAUBINGER
Department Office: 310 Education Building

430. **Elementary School Organization and Administration.** Principal focus of this course is given to conceptual analyses of administrative and supervisory functions of the elementary school. Examination is made of administrative roles in the design, implementation, and improvement of the total educational program. Intensive use is made of research skills and strategies in the investigation of problems of instruction. In summer sessions this course is restricted to those without experience in administration and must be taken with Educational Administration and Supervision 464. Intended primarily for candidates for the master's degree. Prerequisite: Consent of instructor. 1 unit.
438. **Instructional Supervision.** Methods, theories, and research applying to supervision at all levels of public education. Analyses are made concerning the work of curriculum directors, general supervisors, special supervisors, supervising principals, and department heads. Study of supervisory methods, current plans for staff utilization, use of instructional materials, evaluation of educational programs, and evaluation of the effects of supervision are stressed. Prerequisite: Elementary Education or Secondary and Continuing Education 439; Educational Administration and Supervision 460. 1 unit.
440. **Administration and Supervision of Junior and Senior High Schools.** Principal focus of this course is given to conceptual analyses of administrative and supervisory functions of the secondary schools. Problems are then projected through case studies and situational descriptions as a means of examining tasks and processes in such areas as curriculum and instruction, pupil and staff personnel, student activities, school organization, and management and school-community relationships. In summer sessions this course is usually taken with Educational Administration and Supervision 464. Intended primarily for candidates for the master's degree. Prerequisite: Educational Administration and Supervision 460 or consent of instructor. 1 unit.
449. **Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
460. **Public Control and Administration of Education.** A course to provide the basic common understanding of theory and practice in operation and control of schools useful to teachers and other citizens. The course serves as an introductory course for prospective administrative officers and supervisors. Not open to experienced administrators or to students who have taken any of the following courses (or equivalents): Educational Administration and Supervision 430, 440, 461, 462, 464, 465, 466. 1 unit.

461. **Administration of Educational Programs and Personnel.** Study of principles and criteria for analysis of programs at various levels of operation, such as instructional departments and pupil personnel service units, individual schools, local school systems, intermediate units, state education departments, and the federal government. Educational Administration and Supervision 461, 462, and 463 constitute the required core program for all students specializing in educational administration who are candidates for a degree beyond the master's. Prerequisite: Educational Administration and Supervision 460 and 430 or 440. 1 unit.
462. **Organization and Business Administration of Public Education.** Organization and operation of public school government; functions and processes of school business administration, including internal organization of the division of business services; scope and role of the business manager, budgetary process, accounting and financial reporting, contracts, liability, insurance, purchasing, auxiliary services, salary policies, and methods of survey, evaluation, and planning. Prerequisite: Educational Administration and Supervision 460, 430 or 440, and 461. 1 unit.
463. **The Role of Administrative Leadership.** Study of principles underlying administrative leadership drawn from such disciplines as philosophy, psychology, sociology, and public administration. Application of these principles in the analysis and formulation of general procedures by which the process of administration may be carried on most effectively to develop and operate efficient educational programs. Prerequisite: Educational Administration and Supervision 461; Educational Psychology 413 or Educational Administration and Supervision 467. 1 unit.
464. **Field Problems in Educational Administration.** Designed to give direct experience in the study of educational problems of concern to administrators. Each student selects and pursues one or more problems of study under the supervision of a professor. Prerequisite: Consent of instructor. 1 unit.
465. **Personnel Administration.** Principles, problems, and trends in the administration of professional public school personnel; organization of personnel; assessment and definition of personnel needs; recruitment, selection, and induction; evaluation; personnel development programs; and teacher organizations. Prerequisite: Educational Administration and Supervision 430, 440, and 460. 1 unit.
466. **Public School Finance.** Advanced graduate study of the theory and technology of public school finance. Attention is centered on analysis of principles and theory underlying fiscal practice in various states; technical knowledge of designing controls, organization, and fiscal systems in harmony with expressed theory; and the application of research to the analysis of problems related to the improvement of financing public schools. Prerequisite: Admission to advanced graduate program in educational administration and supervision or consent of instructor. 1 unit.
467. **Foundations for Group Processes for Administrators.** A laboratory course in which members study group process through involvement in the class as a group. A text, related readings and relevant reports are used to guide critical study of the ethical, sociopsychological, and methodological ideas and problems underlying management and the improvement of groups. Special attention is given to the function of group leadership in educational settings. Prerequisite: Educational Administration and Supervision 460; Educational Psychology 311; Educational Psychology 312. 1 unit.
468. **School-Community Relations.** Study of the relationship of the American school to the community. Analysis of the power structure, social agencies, school liaison groups, and economic character of the community as they affect and are affected by the school. Includes an evaluation of the various media of communication between the school and the larger community, and the development of criteria for an effective program of school-community relations. 1 unit.
469. **Legal Basis of School Administration.** The legal rights, privileges, responsibilities, immunities, and authority of pupils, parents, teachers, administrators, and school board members in relation to the school. 1 unit.
470. **Educational Facilities Planning.** Study of concepts and techniques for determining

physical needs within the larger environmental context and for translating educational requirements into design criteria. Emphasizes the planning process in relation to (1) community and social considerations, (2) pupil population forecasting, (3) program analysis and performance specification development, and (4) the creation of environments conducive to learning. Prerequisite: Educational Administration and Supervision 460. 1 unit.

490. **Seminar for Advanced Students for Education.** Seminar in educational administration and supervision open only to persons who have been admitted for doctoral study in educational administration and supervision. 1 to 2 units.
491. **Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations 497, Social Work 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector—federal, state, and local. Analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

EDUCATIONAL PRACTICE

Admission to educational practice (student teaching) is limited to students enrolled in appropriate teacher education programs approved by the Urbana Council on Teacher Education. Students in vocational agriculture should enroll in Vocational and Technical Education 276, Student Teaching in Vocational Agriculture. For more detailed information concerning requirements for admission to educational practice, see the Undergraduate Study catalog.

Continuing students in teacher education will be invited to apply for student teaching assignment upon completion of sixty or more semester hours, provided they are in good standing or on provisional status in teacher education. Students entering teacher education curricula with sixty or more semester hours should apply for student teaching assignment during the first semester in the curriculum. However, such students must complete at least a semester before they may be admitted to educational practice. Students eligible for student teaching assignment should obtain application materials from the Office of Student Teaching in 236 Education Building.

Currently enrolled eligible students must apply for student teaching assignments for the next school year by the end of the second week of December. Currently enrolled students submitting applications after this date normally will not be given a student teaching assignment during the next academic year. Prior to the junior year, students who are not to be on the campus during the following fall semester, but who expect to enroll in educational practice during the next school year, should secure application forms from the Office of Student Teaching early in the spring semester.

Educational practice is under the general supervision of the Illinois Teaching Experiences Laboratory. Following is a list of the offices of student teaching serving each teaching area: secondary education, 236 Education Building; elementary education, 304 Education Building; special education, 1005 West Nevada Street, Urbana; and vocational and technical education, 236 Education Building.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **Educational Practice in the Education of Exceptional Children.** A course in practice teaching providing teaching experience with exceptional children. Prerequisite: Senior standing; consent of department; sufficient hours of background courses. 2 to 5 hours.

- 232. Educational Practice in Elementary Education.** A course in practice teaching to meet certification requirements for teaching in the elementary school. Prerequisite: Elementary Education 233 or 237 as required by the student's curriculum; senior standing. 2 to 5 hours.
- 238. Educational Practice for Special Fields in Elementary Schools.** A course in student teaching to meet requirements for certification in special fields at the elementary school level. Prerequisite: For students in the early childhood education curriculum, Elementary Education 334 is required; consent of instructor. 3 or 4 hours.
- 242. Educational Practice in Secondary Education.** A course in practice teaching to meet certification requirements for teaching in the secondary school. Prerequisite: Secondary and Continuing Education 240 or Vocational and Technical Education 240; senior standing. 2 to 5 hours.
- 250. School and Community Experiences.** Observation and laboratory experience in the public schools to prepare students for student teaching. 2 hours.

EDUCATIONAL PSYCHOLOGY

Chairman of Department: Professor M. L. MAEHR

Department Office: 210 Education Building

- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 211. Educational Psychology.** The basic undergraduate course in psychology of education for prospective teachers. Materials and principles from the various areas of psychology (mental hygiene, psychology of learning, etc.) are applied to the practical problems of teaching. Prerequisite: Psychology 100. 3 hours.
- 236. Child Development for Elementary Teachers.** A study of child growth and development designed particularly for those preparing to teach in the elementary school. Special emphasis is given to the significance of the developmental process for educational programs and procedures. Systematic experience in studying and evaluating children's behavior and in handling children. Prerequisite: Psychology 100. 3 hours.
- 249. Independent Study.** Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
- 291. Thesis.** Prerequisite: Senior standing. 2 hours.
- 292. Thesis.** Prerequisite: Senior standing. 2 hours.
- 311. Psychology of Learning for Teachers.** A consideration of learning situations in the light of psychological findings and concepts. Development of a theory of learning and its application to the teaching of attitudes, skills, and understandings. Prerequisite: Educational Psychology 211 and practice teaching or teaching experience. 2 hours or 1/2 unit.
- 312. Mental Hygiene and the School.** An examination of social and emotional adjustment; study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, behavior disorders in children, and introduction to methods of child study and provision for emotionally disturbed children. Prerequisite: Educational Psychology 211 and practice teaching or teaching experience. 2 hours or 1/2 unit.
- 313. Programmed Instruction.** The design, production, and evaluation of self-instructional materials, including delineation of objectives, task analysis, frame writing, frame editing, pilot testing and revision, and field testing; survey of current research and orientations toward programmed instruction; consideration of the mechanized and text forms for presenting programs. Each student prepares a self-instructional program. Prerequisite: Educational Psychology 311. 4 hours or 1 unit.

326. **Introduction to Vocational Rehabilitation Counseling.** A survey of the history and development of vocational rehabilitation programs; contributions of related disciplines and their integration; basic procedures and problems of vocational rehabilitation counseling. Prerequisite: Consent of instructor. 2 hours or 1/2 unit.
339. **Corrective Reading.** Same as Elementary Education 339. Practice in administering and interpreting group diagnostic reading tests. Instructional techniques appropriate for less severe reading disabilities are presented. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.
343. **Individual Intelligence Testing.** The fundamental concepts relevant to the general problem of the individual testing of learning aptitude. Acquisition of psychometric competence in the use of the 1960 Binet and the Wechsler tests. Acquaintance and limited practice in the administration, scoring, and interpretation of results obtained by means of performance scales and other devices appropriate for use with individuals having sensory, associative, and/or motor impairments. Prerequisite: Consent of instructor and six hours of psychology and Special Education 324, or Educational Psychology 392 or Psychology 390. 3 hours or 1 unit.
360. **Educational Uses of Television and Radio.** Same as Radio and Television 360. A study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; experimentation in new production and utilization techniques designed for educational uses. 3 hours or 1/2 unit.
387. **Computer Use in Education.** An overview of the nature and development of automation in education; use of electronic data processing systems for administrative purposes, for instruction, and for research. Discussion of problems of computer management, natural language analysis, simulation CAI applications. Laboratory experience with on-line terminals, remote entry devices, and peripheral equipment. Prerequisite: Educational Psychology 390 or equivalent. 3 hours or 1 unit.
390. **Elements of Educational Statistics.** Designed for terminal value for professional training of students not intending to pursue advanced graduate work, and for introductory value for students continuing graduate study in education. The course includes descriptive statistics, introduction to correlation and regression, the normal curve, statistical inference, and the presentation and interpretation of statistical data in educational literature. 3 hours or 1 unit.
391. **Construction and Use of Tests in Teaching.** Includes the relationship of classroom testing to educational objectives and the curriculum; the construction, administration, and scoring of the various types of essay and short-answer tests; and other means of measuring the attainment of objectives and marking procedure. Designed primarily for classroom teachers. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.
392. **Introduction to the Principles of Measurement.** Study of the selection, preparation, administration, and interpretation of psychological and educational tests and diagnostic devices, with emphasis on theory at a beginning level and with application to hypothetical school situations as a teaching device. Sources of standard tests, criteria for their evaluation, methods of scoring, interpretation, and general and special areas are considered. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.
411. **Psychology of Adolescence for Teachers.** The psychological significance of adolescence, its biological and social foundations, and its implications for education. Prerequisite: Educational Psychology 311 and 312. 1 unit.
412. **Advanced Child Development for Students of Education.** A consideration of the nature of the child and his development during the preschool and elementary school years, with emphasis on development as a process of social learning; interpretation of the scientific literature as it concerns the educative process; discussion of methods of studying and evaluating the behavior of the child as an individual and in group situations. Prerequisite: Educational Psychology 311 and 312. 1 unit.
413. **Social Psychology and the Problems of Education.** A consideration of the concepts and

methods of social psychology as they apply to the professional functions of teachers, administrators, and other persons engaged in education. Opportunity to work upon field problems is provided. Prerequisite: Educational Psychology 311, 312, and 390. 1 unit.

414. **The Psychology of College Teaching.** Designed particularly for graduate students minoring in education or preparing for college teaching. Psycho-educational problems in undergraduate and graduate teaching, with special emphasis upon individual differences, remedial procedures, principles of learning, the technology of teaching and learning, adjustment problems of college students, counseling and advisory services, test construction, analysis and use of test results and resource materials in this field. Prerequisite: A course in psychology; consent of instructor. 1 unit.
415. **Psychological Theories Applied to Education.** An advanced course in human behavior required of all candidates for the degree of Doctor of Education. Special attention is given to contemporary systems of psychology and their relationship to educational practice. Prerequisite: Educational Psychology 311 and 312; Educational Psychology 411 or 412; candidacy for Ed.D. or Ph.D. in Education. 1 unit.
422. **Counseling Theory and Practice.** Study of counseling processes that are especially applicable to the problems of normal individuals. Theories of education and personality which underlie counseling procedures are studied for the purpose of developing the student's ability to evaluate these procedures. Prerequisite: Educational Psychology 311 and 312. 1 unit.
423. **The Use of Tests in Counseling.** Practice in interpreting test results in case studies; study of the implications on test choices and usage of the philosophic orientation of the counselor, the type of case, the case setting, and the case information available; discussion of the advantages and disadvantages of particular tests for given types of cases. Prerequisite: Educational Psychology 392 and 422, or equivalent. 1 unit.
424. **Supervised Practice in Educational Psychology.** Provides the student with intensive supervised experiences in applied educational psychology. Incorporated in these experiences is the use of a wide variety of diagnostic and observational techniques and treatment. Students may take more than one section. Prerequisite (dependent upon section): Master's degree in educational psychology or equivalent; consent of instructor. 1 to 2 units.
425. **Principles and Practices of Student Personnel Services.** For teachers, administrators, student advisers, and others who are interested in basic guidance principles and in guidance methods useful to schools and to agencies dealing with out-of-school youth and adults. Considers the role of guidance specialists and the guidance functions of community agencies. 1 unit.
427. **Principles and Techniques of Group Counseling.** A study of the principles of group guidance and their application. Includes a review of the historical development of group guidance and the study of pertinent research. Discussion and role playing have an important part in the work of the course. Case materials are utilized. Prerequisite: Educational Psychology 311, 312, 422, 423, and 425; or consent of instructor. 1 unit.
428. **Theories of Career Development and the Use of Occupational Information.** Deals with the results of recent occupational research and with the use of these results by teachers and counselors. Attention is given to research techniques suitable for use in local occupational studies. Prerequisite: Educational Psychology 425 or an introductory course in counseling. 1 unit.
429. **Field Instruction in Educational Psychology.** Individual instruction designed to help the advanced student apply the basic principles of counseling. Each student is assigned to a counseling agency. Prerequisite: Educational Psychology 422 and 424 (with consent of instructor, registration in Educational Psychology 424 may be concurrent). 1 or 2 units.
444. **Sociocultural Influences on Learning and Development.** Research and theory relating to the origin and development of achievement-related attitudes, motives, norms, and expectations; issues and problems associated with teaching children of diverse backgrounds. Prerequisite: Educational Psychology 311, 312, and 390, or consent of instructor. 1 unit.

ELECTRICAL ENGINEERING

Head of Department: Professor E. C. JORDAN

Department Office: 155 Electrical Engineering Building

114. **Wiring and Illumination.** Fundamentals of commercial and industrial illumination and wiring practice. Prerequisite: Sophomore standing or consent of instructor. 3 hours. Engineering students receive no credit.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **Basic Electrical Engineering.** Fundamentals of electric and magnetic circuits and characteristics of electron tubes and circuits. Credit is not given for both Electrical Engineering 220 and 260. Prerequisite: Physics 106 and 107; Mathematics 140, 141, or 145. 3 hours. Electrical engineering students receive no credit.
229. **Introduction to Electromagnetic Fields.** Static electric and magnetic fields; elementary electromagnetic field theory as summarized in Maxwell's equations in integral and differential form. Prerequisite: Physics 107; Mathematics 345. 3 hours.
230. **Application and Control of Motors and Equipment.** Plant electrical systems; electric codes; motor types and applications; power control devices and control systems. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
231. **Power Equipment Laboratory.** To accompany Electrical Engineering 230. Prerequisite: Credit or registration in Electrical Engineering 230. 1 hour. Electrical engineering students receive no credit.
232. **Electronics and Electronics Applications.** Theory and application of electronic circuits and equipment. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
233. **Electronics Laboratory.** To accompany Electrical Engineering 232. Prerequisite: Credit or registration in Electrical Engineering 232. 1 hour. Electrical engineering students receive no credit.
234. **Electrical Instruments and Measurements.** Theory and use of electrical instruments with special attention to their use in measuring nonelectrical quantities. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
235. **Electrical Measurement Laboratory.** To accompany Electrical Engineering 234. Prerequisite: Credit or registration in Electrical Engineering 234. 1 hour. Electrical engineering students receive no credit.
244. **Electrical Engineering Laboratory, I.** Introduction to electronic instruments, basic measurement techniques, and basic electronic components. Preparation of the student for experimental projects. Prerequisite: Credit or registration in Electrical Engineering 260. 2 hours.
245. **Electrical Engineering Laboratory, II.** Laboratory projects in various areas of electrical engineering. Prerequisite: Electrical Engineering 244 and 340. 2 hours.
246. **Project Laboratory.** The planning, designing, executing, and evaluating of various experimental projects by the student along with discussion of the actual examples of experimental design error control and data processing. Prerequisite: Senior standing in electrical engineering; consent of instructor. 2 to 4 hours.
249. **Digital Systems Laboratory.** Introduction to the experimental analysis and synthesis of digital networks. Prerequisite: Credit or registration in Electrical Engineering 294 or 391. 2 hours.
260. **Networks, I.** Elementary signals; basic principles of network analysis; sinusoidal steady state analysis. Credit is not given for both Electrical Engineering 260 and 220. Prerequisite: Physics 107; credit or registration in Computer Science 101; Mathematics 345. 3 hours.
262. **Networks, II.** Laplace transforms; role of exponential and sinusoidal signals in system

- analysis for arbitrary wave forms; two-ports and filters as signal processors. Prerequisite: Electrical Engineering 260; Mathematics 345; Computer Science 101. 3 hours.
266. **Probabilistic Methods in Electrical Engineering.** Applications of probabilistic concepts in electrical engineering problems. Models of random phenomena in devices and systems. Elementary analysis and design problems involving statistical models in electrical engineering. Prerequisite: Electrical Engineering 260 or junior standing in electrical engineering. 3 hours.
271. **Electrical Engineering Problems.** Prerequisite: Approved written application to department. 0 to 4 hours.
272. **Electrical Engineering Problems.** Prerequisite: Approved written application to department. 0 to 4 hours.
288. **Economic Aspects of Engineering.** Fundamental principles of engineering economy. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.
290. **Introduction to Information Processing.** Engineering perspective to information processing from a computational standpoint. Analog and digital systems are compared and contrasted to provide an appreciation of their respective characteristics and capabilities. Prerequisite: Computer Science 101; credit or registration in Mathematics 345. 3 hours.
294. **Introduction to the Theory of Digital Machines.** Same as Computer Science 294. An introduction to the general organization of computers. Number systems, Boolean algebra, the design of combinational circuits, and sequencing of arithmetic operations are discussed. Prerequisite: Junior standing in engineering or mathematics. 3 hours.
296. **Honors Project.** A special project or reading course for James Scholars in engineering. Prerequisite: James Scholars in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Preliminary reading and investigation. 0 to 3 hours.
310. **Systems, I.** Fourier transform; matrix algebra; formulation of the normal-form equations in terms of the state variables; solution of the normal-form equation; convolution; stability of systems. Prerequisite: Electrical Engineering 260. 3 hours, or 0 to 3/4 unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Same as Nuclear Engineering 321. Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems. Energy balance; plasma confinement and stability; recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.
323. **Circuit Laboratory.** To accompany Electrical Engineering 350. Prerequisite: Electrical Engineering 251 and 262; credit or registration in Electrical Engineering 350. 1 hour, or 0 to 1/4 unit.
324. **Introduction to Network Synthesis.** An introduction to modern methods of network synthesis. Topics covered include properties of driving-point and transfer functions; approximation and scaling; LC, RC, and RLC synthesis methods; ladder network development; resistively terminated coupling networks. Prerequisite: Electrical Engineering 262 or 310. 3 hours, or 0 to 1 unit.
330. **Electromechanics.** Quasi-static electromagnetic fields; lumped-parameter electromechanics; rotating machines; dynamics of electromechanical systems; fields and moving media. Prerequisite: Electrical Engineering 229 and 260. 3 hours, or 0 to 1 unit.
332. **Electrical Machinery.** Induction machines; single-phase motors; direct-current machines; application. Prerequisite: Senior standing. 3 hours, or 0 to 3/4 unit.
336. **Advanced Analysis of Electric Power Equipment.** Transformers; synchronous and induction machines; power machines in systems; single-phase motors; extension of the two reaction analysis to the general machine. Prerequisite: Senior standing. 4 hours, or 0 to 1 unit.

- 340. Electronics, I. Semiconductor materials and their electronic properties and applications to electronics devices; pn junctions, transistors, and other diode and triode devices; low-frequency applications of diodes.** Prerequisite: Physics 108; Mathematics 345. 3 hours, or 0 to 3/4 unit.
- 342. Advanced Electronics.** Linear and nonlinear amplification; modulation and demodulation concepts; introduction to feedback amplifiers and oscillators. Prerequisite: Electrical Engineering 244, 260, and 340. 3 hours, or 0 or 3/4 unit.
- 344. Theory and Fabrication of Solid State Devices.** A laboratory and lecture course on the physical theory, design, and fabrication of solid state devices which includes the electronic properties of semiconductors (such as mobility, carrier concentration, lifetime, energy gap) and techniques for fabricating (oxidation, diffusion, oxide masking, alloying) pn junction devices. Prerequisite: Electrical Engineering 340. 4 hours or 1 unit.
- 347. Industrial Electronics.** Electronic circuits for automatic control and measurement systems with applications. Students are not given credit toward graduation for both Electrical Engineering 347 and 381. Prerequisite: Electrical Engineering 330 and 342. 4 hours, or 0 or 1 unit.
- 349. Nonlinear Electronic Circuits.** An introduction to the elementary solution of zero, first-, and second-order differentio-integral equations encountered in the study of electronic circuits. Circuits used as examples employ uni- and bipolar transistors, unijunctions, tubes, and other devices. Emphasis is given to nonlinear negative resistance applications in switching applications and in oscillators of the relaxation and quasi-sinusoidal types. Prerequisite: Credit or registration in Electrical Engineering 342. 3 hours, or 3/4 or 1 unit.
- 350. Lines, Fields, and Waves.** Transmission lines, field calculations, and wave propagation. Prerequisite: Electrical Engineering 229 and 260. 3 hours or 3/4 unit.
- 352. Electromagnetic Fields.** Uniform plane waves, wave guides, radiation and propagation of electromagnetic energy, radiating systems, and electrodynamics. Prerequisite: Electrical Engineering 350. 3 hours or 3/4 unit.
- 353. Radio Communication Circuits.** Design of a radio system for transmission of information; types of receivers, matching techniques, receiver and antenna noise, types of modulation, high frequency circuitry, point-to-point and satellite communications. Prerequisite: Electrical Engineering 260; credit or registration in Electrical Engineering 350. 4 hours or 1 unit.
- 354. Antennas.** Antenna parameters; polarization of electromagnetic waves; basic antenna types; broadband antenna design; antenna measurements. Prerequisite: Electrical Engineering 352, Physics 342, or consent of instructor. 3 hours or 1 unit.
- 355. Fields and Waves.** Electromagnetic fields; wave guides; radiation and propagation of electromagnetic energy; radiating systems. Prerequisite: Electrical Engineering 229 and 350, or consent of instructor. 3 hours, or 0 or 3/4 unit.
- 356. Microwave Techniques.** UHF and microwave sources and detectors; laboratory techniques for UHF and microwave frequencies. Prerequisite: Credit or registration in Electrical Engineering 352 or 355. 1 hour, or 0 or 1/4 unit.
- 357. Radio Astronomy.** Same as Astronomy 357. Instrumental theory and observational technique; radar and meteors; the moon and planets; solar radio waves; galactic and extragalactic radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit.
- 359. Introduction to Statistical Communication.** Introduction to random waveforms and noise; effects of noise on waveform and digital communications; optimum receiver, matched filter, signaling. Prerequisite: Electrical Engineering 266 and 310, or equivalent. 3 hours, or 3/4 or 1 unit.
- 361. Introduction to Data Communication.** An introduction to principles of data communication between digital systems such as computers. Discussion includes basic concepts in modulation, source coding, channel capacity, and error-correcting codes. Prerequisite: Senior standing. 3 hours or 1 unit.
- 367. Active Networks.** A study of active device models and their application to electrical

network equation forms. Systems are expressed in terms of their network functions and the characteristics of feedback systems are examined in particular. Sensitivity and stability factors are examined. Prerequisite: Electrical Engineering 342. 3 hours or 3/4 unit.

373. **Engineering Acoustics.** Same as Theoretical and Applied Mechanics 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems. Vibrating string, vibrating membrane, plane waves, spherical waves, vibrating piston, acoustical filters, loudspeakers and microphones, principle of reciprocity, the ear, architectural acoustics. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or 3/4 to 1 unit.
374. **Ultrasonic Techniques.** Ultrasonic wave propagation, generation, detection, and measurement in liquid and solid media, acoustic impedance concepts, ultrasonic absorption phenomena, piezoelectricity, and discussion of selected industrial, experimental, and bioengineering applications with laboratory demonstrations. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Mathematics 345. 3 hours or 1 unit.
376. **Symmetrical Component Analysis of Power Systems.** Representation of power systems; symmetrical component; positive, negative, and zero sequence impedances of network components; sequence networks; unsymmetrical faults; unsymmetrical power systems; matrix algebra in symmetrical component analysis. Prerequisite: Senior standing. 3 hours, or 0 or 1 unit.
378. **Electrical Power Networks.** Steady state power network analysis; inductive coordination; transmission line capacitance and resistance; networks synthesis; application of computers to power network problems. Prerequisite: Senior standing. 3 hours, or 0 or 1 unit.
381. **Pulse Techniques.** An introduction to the response of electrical networks to nonsinusoidal inputs; the analysis of active circuits with large signals; the circuits and techniques used in pulse and digital equipment. Students are not given credit toward graduation for both Electrical Engineering 381 and 347. Prerequisite: Electrical Engineering 342. 4 hours, or 0 or 1 unit.
382. **Transistor Circuits.** This course is the same as Electrical Engineering 383, but has one three-hour laboratory added each week. Prerequisite: Electrical Engineering 342. 4 hours or 1 unit.
383. **Transistor Circuits.** Junction transistors, diodes, and related semiconductor devices. Emphasis equally divided between device properties as related to semiconductor physics and circuit properties. Small signal theory of amplifiers and oscillators, large signal theory of power stages and switching circuits, negative resistance effects, high frequency limitations. Prerequisite: Electrical Engineering 342. 3 hours or 3/4 unit.
384. **Properties of Solids.** Same as Metallurgical Engineering 384. Perfect and imperfect crystal lattices, electronic structure of solids including basic theory and applications to transport properties of metals and semiconductors, semiconductor diodes, dielectric and magnetic properties of solids. Prerequisite: Physics 383. 3 hours or 3/4 unit.
385. **Theory of Semiconductor Computer Devices.** Same as Computer Science 385. Crystal conduction, large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology; masking, oxidizing, and etching. Emphasis on development of device-theoretical background for computer logic design. Prerequisite: Electrical Engineering 294 and senior standing, or consent of instructor. 3 hours, or 3/4 or 1 unit.
386. **Control Systems, I.** Fundamental knowledge required in the analysis of servomechanisms and automatic control devices. Prerequisite: Senior standing in electrical engineering or consent of instructor. 4 hours, or 0 or 1 unit.
387. **Introduction to Quantum Electronics for Electrical Engineers.** Application of quantum mechanical concepts to electronics problems, for example, the generation and detection of coherent radiation, tunneling effects, and bulk oscillations in semiconductors. Prerequisite: Physics 383. 3 hours or 1 unit.

388. **Electronic Analog Computers.** Design of analog computer elements; problem preparation and representative solutions of physical problems. Prerequisite: Electrical Engineering 340, 341, and Mathematics 345, or consent of instructor. 3 hours, or 0 or 1 unit.
390. **Introduction to Optimization.** Same as Mathematics 390. Basic theory and methods for the solution of optimization problems; iterative techniques for unconstrained minimization; introductory presentation of linear and nonlinear programming with engineering applications. Prerequisite: Computer Science 101, Mathematics 343, or consent of instructor. 3 hours or 1 unit.
391. **Switching Theory.** Same as Computer Science and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; pulse-mode and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Introduction to Automata Theory.** Same as Mathematics and Computer Science 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Electrical Engineering 391 or consent of instructor. 3 hours, or 1/2 or 1 unit.
393. **Digital Computer Circuit Design.** Same as Computer Science 393. Design of switching circuits and systems taking into account properties of currently available diodes, transistors, and related circuit elements. Applications to slow-speed as well as high-speed computer circuits and data handling links. Component tolerance, circuit reliability, and cost factors are considered. Prerequisite: Electrical Engineering 342 and Electrical Engineering 294 or 391, or consent of instructor. 3 hours or 1 unit.
394. **Logical Design of Automatic Digital Computer Circuits.** Same as Computer Science 394. A course in the design of automatic digital computers. Major emphasis is on logical structure of components and the interrelations necessary for automatic operation. Prerequisite: Electrical Engineering 294 and senior standing, or consent of instructor. 3 hours or 1 unit.
397. **Projects and Lectures in Quantum Electronics.** Study of processes involving quantum mechanical energy transfers in energized media leading to various lasering devices and their applications. A series of lectures, supplementing the special projects, offers background information on spectroscopy, collisional energy transfer, laser pumping schemes, modulation at optical frequencies, holography, and other related topics. Prerequisite: Senior standing; consent of instructor; Electrical Engineering 387 is recommended. 3 hours, or 0 or 1 unit.
400. **Seminar.** Required of all graduate students. 0 credit.
412. **Advanced Engineering Measurements.** Theory and practice of precision measurements of electric, magnetic, and physical quantities; factors influencing the choice of method. Comparative accuracy and practicability of measurement methods and limitation of technique; evaluation of errors; design and development of measurement apparatus and methods. 1 unit.
414. **Engineering Applications of Linear Graphs.** Same as Computer Science 414. Elementary theory of linear graphs. Euler graphs; incidence, cut-set and circuit matrices and their properties; realizability of cut-set, circuit and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; communication networks. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318. 1 unit.
415. **Control System Theory and Design.** Synthesis of feedback control systems to meet design specifications, including sensitivity; multivariable systems; introduction to systems with random inputs; state variable techniques; nonlinear systems. Prerequisite: Electrical Engineering 386 or equivalent, or consent of instructor. 1 unit.
416. **Analysis of Networks and Systems.** Dynamic equations of linear lumped networks and systems; time-domain analysis and state space methods; frequency-domain analysis and transform methods; stability criteria. Applications to various problems in electrical engineering. Prerequisite: Credit or registration in Mathematics 346 or 348; Electrical Engineering 310. 1 unit.

418. **Electric and Magnetic Fields.** Rigorous treatment of basic laws, static fields, typical field systems, harmonic functions, conjugate functions, conformal transformation. 1 unit.
420. **Electromagnetic Waves and Radiating Systems.** Fundamental electromagnetic theory with applications to transmission lines, waveguides, and antennas; introduction to the solution of advanced problems in static electric and magnetic fields. Prerequisite: Electrical Engineering 352. 1 unit.
421. **Advanced Electromagnetic Engineering.** Reciprocity and equivalence principles; formulation of scattering and diffraction problems; approximations for large and for short wavelengths; plane cylindrical, and spherical wave problems; variational methods; Wiener-Hopf techniques; applications to antennas and waveguide problems. Prerequisite: Electrical Engineering 420. 1 unit.
422. **Controlled Fusion Systems.** Same as Nuclear Engineering 422. Development of plasma models for fusion analysis. Treatment of plasma heating and confinement with applications to current experiments. Energy balances and energy extraction, minimum-B configuration, instability criteria, Tokamak machines, pinch systems, mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
423. **Gaseous Electronics and Plasmas.** Basic concepts and techniques, both theoretical and experimental, which are used in the areas of gaseous electronics, gas and solid plasmas, controlled fusion, aeronomy, gas lasers, and magnetohydrodynamics. Prerequisite: Physics 383 and Electrical Engineering 352, or equivalent, or consent of instructor. 1 unit.
425. **Nuclear-Electrical Energy Conversion.** Same as Nuclear Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection. Analysis and applications of direct collection of charged particles. Radiation-induced ionization and excitation theory and application. 1 unit.
428. **Analysis of Nonlinear Systems.** Same as Theoretical and Applied Mechanics 428. Singular points and stability considerations are treated. Graphical and analytical methods, including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations, are considered. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
431. **Theory of Guided Waves.** Propagation in general cylindrical waveguides; eigenvalue problems, stationary principles, microwave circuit theorems, boundary value problems, and the determination of circuit parameters; periodically loaded waveguides with anisotropic media. Prerequisite: Electrical Engineering 420. 1 unit.
432. **Compound Semiconductors (Optical Devices).** This course is concerned mainly with the properties of III-V and II-VI compound semiconductors and the devices which are unique to these materials. Major emphasis is placed in this course on materials such as GaAs, Ga(AsP), GaP, CdSe, Cd(SeS), etc., and in luminescence, semiconductor lamps and semiconductor lasers. Prerequisite: Graduate standing in electrical engineering with some background in modern physics, elementary quantum mechanics, and elementary semiconductor theory (or equivalent). 1 unit.
434. **Random Processes and Linear Filtering.** Basic concepts of random processes; spectral analysis; linear systems with random inputs. Applications of random processes in communications and control theory: parameter estimation and linear filtering. Prerequisite: Mathematics 361 or equivalent, or Electrical Engineering 359. 1 unit.
435. **Theory of Semiconductors and Semiconductor Devices.** Same as Physics 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; characteristics of p-n junctions, heterojunctions, and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
437. **Principles of Microwave Measurements.** Generation and detection of the laboratory signal; the generalized impedance concept; matrix representation of waveguide discontinuities; determination of equivalent network parameters; analysis of measurement techniques by signal flow graphs; accuracy criteria. Prerequisite: Electrical Engineering 355 and 356. 1 unit.

438. **Stochastic Processes in Engineering.** Same as Aeronautical and Astronautical Engineering 453 and Theoretical and Applied Mechanics 418. Supplementing Aeronautical and Astronautical Engineering 453, Electrical Engineering 434, or Theoretical and Applied Mechanics 417 for additional engineering application of stochastic processes. Theories of random pulses and continuous Markov processes and their applications to dynamic and control systems; parametric excitations and stability; nonlinear devices; topics related to system failures. Prerequisite: Aeronautical and Astronautical Engineering 452, Electrical Engineering 434, or Theoretical and Applied Mechanics 417, or equivalent. 1 unit.
439. **Advanced Theory of Semiconductors and Semiconductor Devices.** Continuation of Electrical Engineering 435. Selected advanced topics of current interest in the physics of semiconductors and solid state devices. Prerequisite: Electrical Engineering 435. 1 unit.
440. **Advanced Power Circuit Analysis, I.** Analysis of power systems by symmetrical and related components; equivalent circuits of lines, transformers, and machines; fault calculations on symmetrical and unsymmetrical power systems; the network analyzer in fault studies. 1 unit.
445. **Power System Stability.** Transient and steady-state stability in power systems; power flow equations; transient stability swing curves; critical clearing time; the network analyzer in stability studies; the analog computer in transient stability studies. Prerequisite: Electrical Engineering 440. 1 unit.
451. **Advanced Network Synthesis.** Active network synthesis; sensitivity of networks; scattering matrix, broad band matching, computer-aided design of filters and matching networks. Prerequisite: Electrical Engineering 324 or equivalent; credit or registration in Mathematics 346. 1 unit.
452. **Time-Varying and Nonlinear Circuits.** Energy considerations; equations in normal form; frequency power relations in nonlinear networks; frequency conversion; Lyapunov's direct method; the circle stability criterion; calculus of variations and Hamilton's principle applied to the stability and matching problems. Prerequisite: Electrical Engineering 416; Mathematics 346. 1 unit.
453. **Optimum Control Systems.** Formulation of the optimization problem; controllability; observability; stability, Lyapunov's second method; application of variational calculus, maximum principle and principle of optimality to control problems; stochastic control; adaptive control. Prerequisite: Electrical Engineering 415. 1 unit.
454. **Sampled-Data Control Systems.** Analysis and design of feedback control systems with digital and sampled data. Prerequisite: Electrical Engineering 386 or 415, or equivalent. 1 unit.
456. **Coding Theory.** Same as Computer Science 456. General discussion on coding theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; applications to computers and data-transmission systems. Prerequisite: Mathematics 317 or equivalent, or consent of instructor. 1 unit.
463. **Information Theory.** Same as Computer Science and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361 or equivalent. 1 unit.
465. **Topics in Automata Theory.** Same as Computer Science and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. Prerequisite: Electrical Engineering 392 or consent of instructor. 1 unit.
467. **Atomic Collision Processes.** Same as Physics 467. Elastic collisions of electrons with neutral atoms; inelastic electron-atom and electron-molecule collisions; collisions between heavy particles; molecule formation; photoprocesses and recombination; negative ions; collisions involving the emission of radiation; theory of spectral linebroadening in plasmas; experimental techniques. Prerequisite: Physics 480 or consent of instructor. 1 unit.
470. **Nonlinear Optics.** Light propagation in anisotropic crystals, second and third order

nonlinear susceptibility and electrooptic effect, and the relationship of these effects are discussed along with such applications as light modulation, harmonic generation, and optical parametric amplification and oscillation. Prerequisite: Electrical Engineering 420. 1 unit.

472. **Quantum Electronics.** A brief theoretical introduction to quantum mechanics and atomic physics, with many applications in spin resonance and modern maser theory. Prerequisite: Physics 381. It is recommended that Physics 362 and 385 be taken before registering in this course. 1 unit.
474. **Problems of Cybernetics.** Same as Biophysics and Communications 436. The study of brain-like process in complex dynamic systems with emphasis on unsolved problems, current developments, and opportunities for research. Prerequisite: Consent of instructor. 1 unit.
475. **Ionospheric Radio Propagation.** Propagation in a stratified medium; WKB solution; ray theory; ionospheric sounding; ionospheric transmission problems; scattering by irregularities; propagation in a random medium; cross-modulation and nonlinear effects; magneto-ionic theory; Faraday effect; whistler propagation; coupling of characteristic waves; magneto-hydrodynamic waves; formation of ionospheric E-region; formation of F-region. Prerequisite: Electrical Engineering 420 or equivalent. 1 unit.
477. **Advanced Antenna Theory.** Selected topics from recent engineering literature on antennae supplemented by advanced topics in electromagnetic theory needed for comprehension. Current techniques for analysis of wire, slot, horn, frequency independent, quasi-optical and array antennae. Prerequisite: Electrical Engineering 420. Offered in 1973-1974 and in alternate years. 1 unit.
481. **Threshold Logic.** Same as Computer Science 481. Mathematical model of computer elements which work under threshold or majority principle; mathematical theory of threshold functions; realizability using a linear programming approach; network syntheses of majority principle devices. Prerequisite: Consent of instructor. 1 unit.
482. **Theory of Digital Computer Arithmetic.** Same as Computer Science 482. This course emphasizes the use of redundancy in the representation of digits in order to increase the efficiency of computer arithmetic. Topics include multiplier recoding, division with redundantly represented quotients, and structural redundancy as implied by carry-save and signed-digit techniques. Prerequisite: or Electrical Engineering 394. 1 unit.
485. **Advanced Theory of Magnetic and Optic Computer Memory Devices.** Same as Computer Science 485. Theory of ferromagnetism and superconductivity applied to memory devices; light propagation in anisotropic media: modulators and deflectors; principles of laser operation. Prerequisite: Electrical Engineering 385. 1 unit.
486. **Constitution of the Ionosphere: An Introduction to Aeronomy.** Same as Astronomy 486. Properties of the neutral and ionized atmosphere above 60 km. height, and the photochemical processes causing them; diffusion of ionospheric constituents; solar and meteoric perturbations of the ions of the ionosphere. Prerequisite: Graduate standing in electrical engineering, physics, or astronomy; Mathematics 341 or equivalent. 1 unit.
490. **Seminar in Special Topics.** Lectures and discussions on current research and literature on advanced topics in electrical engineering. Prerequisite: Advanced standing; consent of instructor. 0 to 1/2 unit. Course may be repeated.
497. **Electrical Engineering Problems.** Lectures and discussions relating to new areas of interest. Prerequisite: Consent of instructor. 0 to 1 unit. Course may be repeated.
498. **Individual Study.** Individual projects. Prerequisite: Consent of instructor. 1/2 to 2 units.
499. **Thesis Research.** 0 to 4 units.

ELEMENTARY EDUCATION

Acting Chairman of Department: Professor H. H. LERCH

Department Office: 304 Education Building

199. **Undergraduate Open Seminar.** 0 to 9 hours.
230. **Principles, Problems, and Issues in Elementary Education.** Focuses on the problems and issues facing the classroom teacher in curriculum development, planning, and evaluation; develops and applies educational principles which serve to guide the teacher in dealing with these problems and issues. Prerequisite: Registration in Educational Practice 232. 3 hours.
233. **Classroom Programs in Childhood Education.** Organizing balanced daily programs in childhood education; planning and using materials of instruction; evaluating pupil achievement. Prerequisite: Junior standing; Educational Psychology 236. 2 hours.
235. **Teaching Social Studies in the Elementary School.** A course to help prospective elementary teachers develop concepts with reference to the function of the elementary school in the development of social ideas and ideals with children. Special consideration is given to the social studies as the core of the elementary school curriculum. Prerequisite: Junior standing. 3 hours.
237. **Theory and Process in Elementary School Teaching.** This course is directed toward affecting prospective teacher insight with regard to classroom behavior in teaching. It includes materials dealing with the factors of child learning, teaching theory, and elementary school curriculum. A six-week morning assignment to a public school classroom is part of the course structure. Prerequisite: Educational Psychology 236. 5 hours.
248. **Speech Correction Methods in the Schools.** Same as Speech 248. A study of methods and materials used by the school speech correctionist. Prerequisite: Speech 388. 3 hours.
249. **Independent Study.** Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
332. **Principles and Practices in Elementary Mathematics Education.** Organization, scope, and sequence of the elementary mathematics program and the functional nature of mathematics; methods, techniques, experiences, and materials of value in teaching elementary mathematics, and the role of classroom teacher. Prerequisite: Mathematics 202 and 203 or equivalent. 3 hours, or 1/2 or 1 unit.
333. **The Teaching of Language Arts in the Elementary School.** Concerns itself with goals, content, and teaching problems involved in the devising of programs in the area of elementary school language arts that are cumulative and sequential from kindergarten through the elementary school. Prerequisite: Elementary Education 237; Educational Psychology 236. 3 hours, or 1/2 to 1 unit.
334. **Principles and Practices in Early Childhood Education.** A study of the practices and principles of using play as an educational tool in early childhood education. Presents a review of historical, philosophical, and psychological foundations of nursery-kindergarten methods, assesses techniques relating play to various aspects of instruction, surveys materials and equipment, and presents methods of classroom evaluation. Prerequisite: Elementary Education 237. 3 hours, or 1/2 or 1 unit.
335. **Science in the Elementary School.** The principles, place, and practice of science education in the elementary school and in the lives of children. The course stresses the functional nature of science and its place in the curriculum. Consideration is given to the organization of the science program, experiences and techniques of value in teaching, and of the role of the classroom teacher and specialist. Opportunity for experience

in field and laboratory work. Prerequisite: Elementary Education 237 or equivalent; two years of college science. 3 hours or 1/2 unit.

336. **Fundamentals of Reading Techniques.** Basic principles, techniques, and materials for the developmental reading program. Emphasis is placed on methods and materials which provide for differentiated instruction. Prerequisite: Junior standing; registration in a teacher education curriculum. 3 hours, or 1/2 or 1 unit.
337. **Art Education in the Elementary School.** Methods, plans, and materials for teaching art as an integral part of the total educational program in the elementary school. Prerequisite: Junior standing. 3 hours or 1/2 unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Secondary and Continuing Education 338. Developmental reading programs beyond the primary grades. Factors related to reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Educational Psychology 211; junior standing. 3 hours, or 1/2 or 1 unit.
339. **Corrective Reading.** Same as Educational Psychology 339. Practice in administering and interpreting group diagnostic reading tests. Instructional techniques appropriate for less severe reading disabilities are presented. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.
354. **Audio-Visual Communication.** Same as Library Science and Secondary and Continuing Education 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or 1/2 or 1 unit.
431. **Elementary School Classroom Programs.** An exploration of organizational centers for determining selection and sequence of educative experiences in the elementary school classroom. The role of the teacher in curriculum construction is emphasized. 1 unit.
432. **Clinical Diagnosis and Remediation in Reading.** Supervised experience in the Reading Center; special attention is given to evaluative and interpretative techniques in cases of severe reading disabilities based on the analysis of specific reading needs. Prerequisite: Elementary Education 339; a course in individual mental testing. 1 unit; may be repeated for a maximum of 2 units.
433. **Curriculum Problems and Trends in Special Fields of Elementary Education.** A study of the place of the various special fields of elementary education in the emerging elementary school curriculum, with a review and analysis of recent trends and research findings in these fields. Sections are usually offered in the following fields: (a) language arts, (b) social studies, (c) mathematics, (d) science, (e) creative arts, (f) reading, (g) early childhood education, (h) teacher education. Prerequisite: For all sections, Elementary Education 431 or 434, or consent of instructor; for the section in language arts, Elementary Education 333 and 336, or a course in the teaching of reading or language arts, or consent of instructor; for the section in creative arts, Elementary Education 337 or consent of instructor; for the section in science, Elementary Education 335 or a methods course in teaching science in the elementary school and two years of college science, or consent of instructor; for the section in reading, Elementary Education 336 or a course in teaching of reading; for the section in early childhood education, Elementary Education 434 or consent of instructor. 1 unit.
434. **Programs in Early Childhood Education.** An advanced course intended primarily for teachers and supervisors of younger children, ages three to eight. Presents a review and analysis of research findings, experimentation, and current trends in curriculum organization, procedures, and materials essential to developing classroom programs for children. 1 unit.
435. **Diagnosis and Correction in Elementary Mathematics.** The nature, causes, and correction of mathematical difficulties at the elementary level; process of evaluation through group and individual procedures; the development and use of diagnostic instruments

and corrective technique; supervised experience with pupils having difficulties. Prerequisite: Elementary Education 332 and Educational Psychology 392, or equivalent. 1 unit. May be repeated for a maximum of 2 units.

- 436. Field Instruction in Reading Programs.** Provides for directed practice in the area of reading; students are placed in an approved and supervised field position for part of the semester. Prerequisite: Elementary Education 432. 1 unit.
- 437. Methods of Child Study.** A study of ways in which teachers can evaluate child behavior and development. Particular emphasis is placed on classroom application. Instruction and practice in the use and interpretation of observations, anecdote records, rating scales, interviews, achievement tests, intelligence tests, questionnaires, sociometric and projective techniques. Prerequisite: Educational Psychology 312 or consent of instructor. 1 unit.
- 438. The Organization and Supervision of School Reading Programs.** Study of procedures for planning, improving, and evaluating reading programs on a system-wide basis. Open only to those persons who are preparing to supervise reading programs or with approval of graduate adviser. Prerequisite: Elementary Education 339; Elementary Education 433 (reading section). 1 unit.
- 439. Fundamentals of Curriculum Development.** Designed to explore and clarify the several theoretical bases offered in educational literature for each of the major aspects of curriculum planning, to indicate the forms implementation of these theories have assumed in practice, to reduce these theoretical and practical differences to fundamental issues, to encourage critical evaluation of both the theories and practices from the standpoint of logical and empirical evidence, and to project, on the basis of such analysis, needed research, present best practice, and ultimately desirable programs. 1 unit.
- 449. Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
- 455. Theories of Art Education.** A study of the major theories of art education and an analysis of the most significant research in the field. Emphasis is given to a critical evaluation of theory and research and to the application of such studies to current problems in art education in the public schools. Prerequisite: Elementary Education 337 or Secondary and Continuing Education 456, or consent of instructor. 1 unit.
- 459. Workshop in Curriculum Development.** Curriculum development projects in specialized fields of elementary education. 1 to 2 units.
- 490. Seminar for Advanced Students of Education.** Seminar in elementary education open only to persons who have been admitted for doctoral study in elementary education. 1 to 2 units.
- 491. Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
- 499. Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

ENGINEERING

Program Administrator: Professor H. L. WAKELAND

Office: 101 Engineering Hall

100. **Engineering Lecture.** Engineering lecture for freshmen. Selected topics each week. Required of freshmen in the College of Engineering. 0 credit.
101. **Cooperative Engineering Education Seminar.** A discussion seminar which gives an introduction to cooperative engineering education. Topics discussed include duties and responsibilities of the student, duties and responsibilities of the cooperative employer, and techniques for obtaining maximum benefits from the program. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.
102. **Cooperative Engineering Education Practice.** The off-campus practice of engineering in government or industry. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

ENGINEERING HONORS

Executive Secretary of Engineering Honors Program: Professor D. R. OPPERMAN

Program Office: 101 Engineering Hall

196. **The Engineer and Society.** Prerequisite: Freshman James Scholar. 2 hours.
197. **The Engineer and His Profession.** Prerequisite: Freshman James Scholar. 1 hour.
198. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester for freshman James Scholars to enable them to explore at their own level various aspects of technology that are of interest to them. Prerequisite: Honors student in the University. 1 to 4 hours.
297. **College Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester in special interdisciplinary subjects of current interest for James Scholars in engineering. Prerequisite: James Scholar in engineering or consent of instructor. 1 to 4 hours.

ENGLISH

(Including Rhetoric and Composition, English as a Second Language, and Business and Technical Writing)

Head of Department: Professor G. HENDRICK

Department Office: 100 English Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: A course in Shakespeare and twenty additional hours in English, excluding English 101, 102, 103, 115, 116, 195, 196, and Rhetoric 101, 102, 107, 108, 200, 202, 251, 271, 272. Of these twenty additional hours, seventeen must be taken in English or American literature, including three hours from each of the following groups: (1) American literature: English 255, 256; a student who has credit for both English 113 and 114 may offer English 272, 273, 287, 288, 316, 352, 353, 354, 359, 375, 376, 377, or 380; (2) English literature prior to 1616: English 221, 235, 311, 325, 326, or 336; (3) English literature from 1616 to 1800:

English 245, 342, 345, 346, 348, or 349; (4) English literature from 1800 to the present: English 246, 263, 264, 281, 282, 283, or 284.

Prerequisite to the English major is six semester hours of introductory literature: English 101 and either 102 or 103, or English 195 and 196. If necessary, these courses may be taken concurrently with advanced courses.

English majors who intend to teach in secondary schools must see the teacher education adviser in the Department of English. A student who plans to attend graduate school should take into account the entrance requirements of the graduate department he wishes to enter.

Note: A new major has been proposed but not finally approved. Prospective majors should consult the undergraduate advising chairman.

Minors: An approved sequence of twenty hours in one or two of the following subjects, with at least eight hours in the lesser if two are chosen: anthropology, economics, foreign language, history, humanities, library science, mathematics, philosophy, political science, psychology, sociology and speech; or an approved sequence in history of architecture, history of art, or music (not including applied music) either as a complete minor or combined with any one of the above subjects. The program in Asian studies is accepted as a sole minor. With the written approval of the department adviser, other subjects may be substituted. No courses unless approved by the adviser will satisfy minor requirements if they are excluded from the majors of their departments except French 103, 104, German 103, 104, Latin 101, 102, 103, Portuguese 103, 104, Russian 103, 104, and Spanish 103, 104. Foreign language department courses presenting foreign literature in translation are also excluded.

Departmental Honors Program and Distinction: The Department of English offers three courses (English 295, 296, 297) which are restricted to English and English education majors with a grade point average of 4.25. In addition it offers a tutorial (English 298) leading to the writing of a thesis. A student may earn consideration for the rank of Distinction in English in the following ways:

1. Nine hours of honors seminars plus English 293.
2. Nine hours of honors seminars plus English 298.
3. Six hours of honors seminars plus English 293 and 298.

For Distinction in English, the student must write a thesis. Students should not enroll in English 298 unless they have already taken enough honors work to enable them to complete the program. This work must be taken in addition to the regular requirements for the English major. Any course which satisfies a group requirement for the major will be so designated in the Time Table.

The specific level of Distinction is determined by the Honors Committee, the seminar instructors, the student's tutor, and such other faculty members as may be asked to read the honors thesis. If, in the opinion of this group, a candidate fails to earn any kind of Distinction, he will still receive credit for the honors courses he has taken. This group may also award a prize for the outstanding honors essay written in an academic year.

An English education major whose schedule is too crowded to permit him to take the twelve hours required may, with the specific approval of the English education adviser, earn consideration for Distinction by completing two seminars plus English 298. English education majors who are in doubt about their programs should consult with their adviser.

English

101. **Introduction to Poetry.** Reading and discussion of representative poems of several periods and types. 3 hours.
102. **Introduction to the Drama.** Reading and discussion of representative plays of several periods and types. 3 hours.
103. **Introduction to Fiction.** Reading and discussion of representative fiction of several periods and types. 3 hours.
106. **Literature and Experience.** Understanding of the relationship between literature and human experience through the study of significant, recurrent themes. 3 hours.

115. **Masterpieces of English Literature.** A study of selected major writings. 3 hours.
116. **Masterpieces of American Literature.** A study of selected major writings. 3 hours.
195. **Freshman Honors Seminar, I.** An introduction to the study of literature, with emphasis on individual work in fundamental problems of literary analysis, chiefly of short fiction and non-dramatic poetry. Prerequisite: James Scholar standing or other designation as a superior student. This course will fulfill the Group I, Criticism, requirement for the English major. 3 hours.
196. **Freshman Honors Seminar, II.** A continuation of English 195, with emphasis on the applicability of classification according to literary mode in solving the fundamental problems of criticism. Prerequisite: English 195 and James Scholar standing or other designation as a superior student. This course will fulfill the Group I, Criticism, requirement for the English major. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Literary Analysis and Evaluation.** Study and practice in intensive critical analysis with attention to several critical methods. 3 hours.
202. **Medieval Literature and Culture.** British and Continental authors (including Chaucer) read in modern English. 3 hours.
203. **Chaucer.** A selection read in Middle English. 3 hours.
204. **Renaissance Literature and Culture.** Readings in English and continental literary masterpieces with attention to the significant cultural influences of the period. 3 hours.
205. **Introduction to Shakespeare.** 3 hours.
206. **Literature and Culture of the Enlightenment.** Readings in English and continental literature of the century, with attention to significant cultural influences. 3 hours.
207. **Nineteenth-Century Literature and Culture.** English and continental literature of the century, with attention to major intellectual and social movements. 3 hours.
240. **The English Romantic Poets.** Wordsworth, Scott, Coleridge, Byron, Shelley, Keats. 3 hours.
241. **The Beginnings of Modern Poetry.** American and British poets, including Frost, Robinson, Sandburg, Lindsay, Hardy, Hopkins, Housman, Yeats, Lawrence, the Imagists, and the early Pound and Eliot. 3 hours.
242. **Poetry Since 1940.** 3 hours.
243. **Development of the Modern Drama.** Ibsen to O'Neill. 3 hours.
244. **Development of the Modern Drama.** Pirandello to the present. 3 hours.
245. **The Short Story.** A historical and critical study of the short story (American and European) from the early nineteenth century to World War I. Major emphasis on such authors as Hawthorne, James, Crane, Gogol, Chekhov, Maupassant, Flaubert, Joyce, Mansfield. Prerequisite: One course in English or American literature. 3 hours.
246. **The Short Story.** A historical and critical study of the short story (American and European) from World War I to the present. Major emphasis on such authors as Anderson, Hemingway, Faulkner, Porter, Mann, Kafka, Maugham, Lawrence, Salinger, and Camus. Prerequisite: One course in English or American literature. 3 hours.
247. **The British Novel.** A critical study of representative British novels from different literary periods. 3 hours.
248. **The European Novel.** Thematic interrelationships and contemporary relevance of such writers as Gogol, Turgenev, Dostoevsky, Flaubert, Tolstoy, Zola, Mann, Hesse, Kafka, and Camus. 3 hours.
249. **The American Novel.** Study of major and representative novels from the beginnings to the present. 3 hours.
255. **Survey of American Literature, I.** American literature and its cultural backgrounds to 1900. 3 hours.
256. **Survey of American Literature, II.** American literature and its cultural backgrounds in the twentieth century. 3 hours.

259. **Afro-American Literature, I.** A historical and critical study of Afro-American literature in its social and cultural context from the beginning to 1915. 3 hours.
260. **Afro-American Literature, II.** A historical and critical study of Afro-American literature in its social and cultural context since 1915. 3 hours.
273. **Film as Literature.** 3 hours.
274. **Literature in its Cultural Contexts.** Studies of literature from the point of view of other disciplines. Topics to be announced. 3 hours.
275. **Literature and Psychology.** Psychological and psychoanalytical theories in their bearings on the interpretation of literature. 3 hours.
293. **Independent Study.** Study of selected topics. Prerequisite: Consent of instructor. 0 to 3 hours. May be repeated for a total of 6 hours. Students may register in this course more than once in the same term.
295. **Honors Seminar, I.** Themes, movements, and forms in British and American Literature. Restricted to English and English education majors with a grade-point average of 4.25. Enrollment through the English Honors Office necessary. 3 hours. Offered every semester with varying topics; may be repeated as topic varies.
296. **Honors Seminar, II.** Periods in British and American Literature. Restricted to English and English education majors with a grade-point average of 4.25. Enrollment through the English Honors Office necessary. 3 hours. Offered every semester with varying topics; may be repeated as topic varies.
297. **Honors Seminar, III.** Major British and American Authors. Each seminar considers one or two major authors. Restricted to English or English education majors with a grade-point average of 4.25. Enrollment through the English Honors Office necessary. 3 hours.
298. **Senior Honors Tutorial.** Independent research with a chosen tutor leading to the writing of a thesis. Candidates for Distinction in English must take either English 293 or English 298; they may take both. Restricted to English or English education majors with a 4.25 average who have satisfied all other requirements towards the degree with Distinction. Enrollment in the English Honors Office necessary. 3 hours.
301. **Introduction to the Study of the English Language.** Language theories and modes of language study applied to English. 3 hours or 1 unit.
302. **Descriptive English Grammar.** 3 hours or 1 unit.
303. **Historical Introduction to the English Language.** Credit is not given for both English 303 and 403. 3 hours or 1 unit.
304. **Old English.** An introduction to the language before 1000 A.D. 3 hours or 1 unit.
305. **Middle English.** Introduction to Middle English dialects, with special emphasis on the East Midland. Prerequisite: Consent of instructor. 3 hours or 1 unit.
309. **Beowulf.** Prerequisite: English 304 and one year of college study of literature, or consent of instructor. 3 hours or 1 unit.
310. **Old English Literature and Its Cultural Background.** Prerequisite: English 304 and one year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
311. **Chaucer: The Canterbury Tales.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
312. **Chaucer: Troilus and Criseyde and the Minor Poems.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
313. **Middle English Literature and Its Cultural Background.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
315. **Non-Dramatic English Literature, 1500-1600.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
316. **Tudor Drama Exclusive of Shakespeare.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.

317. **Spenser.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
318. **Shakespeare, I.** Earlier tragedies, comedies, history plays. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
319. **Shakespeare, II.** Mature tragedies, dark comedies, late romances. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
321. **Non-Dramatic English Literature, 1600–1660.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
322. **English Drama, 1603–1642.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
323. **Milton.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
325. **English Literature of the Restoration.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
326. **English Literature of the Early Eighteenth Century.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
327. **English Literature of the Later Eighteenth Century.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
328. **English Drama of the Restoration and Eighteenth Century.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
329. **Restoration and Eighteenth-Century Fiction.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
331. **English Romantic Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
333. **Early Victorian Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
334. **Later Victorian Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
335. **Nineteenth-Century Fiction.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
341. **British Literature in the Twentieth Century to 1930.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
342. **British Literature in the Twentieth Century Since 1930.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
343. **The Plays of Bernard Shaw.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
346. **American Literature of the Colonies and Early Republic.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
347. **Literature of the American Renaissance.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
350. **American Literature from the Civil War to the First World War.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
351. **American Literature from World War I to the Present.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
355. **Major Authors.** Intensive study of the work of one or two major authors. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
361. **Topics in English Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
362. **Topics in American Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.

363. **Special Topics in the Study of Literature.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
364. **Tragedy.** History and theory of stage tragedy. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
365. **Comedy.** History and theory of stage comedy. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
366. **Topics in Modern Drama.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
367. **The International Folk Tale.** Same as Comparative Literature 359. The origin, nature, and distribution of the folk tale. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
368. **The Ballad and Folksong in the United States.** English-language traditional songs and ballads, transplanted and native. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
375. **Topics in the Relation of Other Disciplines to the Study of Literature.** Topics to be announced. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
381. **Theory and Practice of Written Composition.** History and theory of written composition; basic rhetorical principles; guidance and criticism of student writing. Prerequisite: One year of college study of writing, or consent of instructor. 3 hours or 1 unit.
382. **Literary Criticism from Plato to 1800.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
383. **Literary Criticism from 1800 to the Present.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
385. **Literature for the High School.** Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
387. **Introduction to the Methodology of Myth and Folklore.** Same as Comparative Literature, German, and Slavic 394, and Speech 346. Prerequisite: One year of college study of literature, or consent of instructor. 3 hours or 1 unit.
403. **History of the English Language.** A study of the development of the language from the earliest stages to the present. Credit is not allowed for both English 403 and 303. 1 unit.
404. **Seminar in the English Language.** Prerequisite: Consent of instructor. 1 unit.
414. **Seminar in Medieval Literature.** Prerequisite: A college course devoted entirely to an aspect of medieval studies, or consent of instructor. 1 unit. May be repeated as topic varies.
419. **Seminar in Shakespeare.** Prerequisite: A college course devoted entirely to an aspect of Shakespeare's work, or consent of instructor. 1 unit. May be repeated as topic varies.
420. **Seminar in Sixteenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
424. **Seminar in Seventeenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
427. **Seminar in Restoration and Eighteenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of eighteenth-century studies, or consent of instructor. 1 unit. May be repeated as topic varies.
433. **Seminar in Romantic Literature.** Same as Comparative Literature 452. Prerequisite: A college course devoted entirely to an aspect of Romantic studies, or consent of instructor. 1 unit. May be repeated as topic varies.
437. **Seminar in Victorian Literature.** Prerequisite: A college course devoted entirely to an aspect of Victorian studies, or consent of instructor. 1 unit. May be repeated as topic varies.
443. **Seminar in Modern British Literature.** Prerequisite: One college course devoted entire-

- ly to an aspect of modern British studies, or consent of instructor. 1 unit. May be repeated as topic varies.
447. **Seminar in Earlier American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
453. **Seminar in Later American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
463. **Seminar in Literary Themes and Movements.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
464. **Seminar in Literary Modes and Genres.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
469. **Seminar in the Stage History of Classic English Plays.** Same as Speech and Theatre 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history, or consent of instructor. 1 unit.
478. **Seminar in the Relation of Other Disciplines to the Study of Literature.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
481. **Seminar in Literary Theory and Criticism.** Prerequisite: A college course devoted entirely to criticism, or consent of instructor. 1 unit. May be repeated as topic varies.
483. **Seminar in Literary Criticism and the Teaching of English.** Prerequisite: One year of college study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
487. **Seminar in the Teaching of English.** Prerequisite: One year of college study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
489. **Seminar in Bibliographical Method.** 1 unit.
491. **Research in Special Topics.** Independent study under the guidance of a member of the graduate faculty. 1 unit. May be repeated for a total of 2 units.
492. **General Examination Tutorial.** Reading for the general examination under the guidance of a member of the graduate faculty. Prerequisite: Doctoral standing. 1 unit. May be repeated for a total of 2 units taken concurrently or in a sequence.
493. **Professional Seminar in the Teaching of College English.** Prerequisite: Doctoral candidate standing or consent of instructor. 1 unit. May be repeated as topic varies.
499. **Thesis Research.** Guidance in writing theses for doctoral degrees. Prerequisite: Doctoral candidate standing. 0 to 4 units.

Rhetoric and Composition

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in English, including ten hours in literature (chosen from English 131 and English courses at the 200 or 300 levels) and ten hours of writing (chosen from Rhetoric 143, 144, 205, 206, 227, 246, 255, 263, and 330). At least one course in expository writing (Rhetoric 143, 227) is required. With an adviser's permission, Speech 363 or Journalism 326 may be counted toward the major. Rhetoric majors who intend to teach in secondary schools must see the teacher-education adviser in the Department of English. A student who plans to attend graduate school should take into account the entrance requirements of the graduate department he wishes to enter.

Minors: An approved sequence of twenty hours in one or two of the following subjects, with at least eight hours in the lesser if two are chosen: anthropology, economics, foreign language, history, humanities, law, library science, mathematics, philosophy, political science, psychology, sociology, and speech; or an approved sequence in history of architecture, history

of art, or music (not including applied music) either as a complete minor or combined with any of the above subjects. The program in Asian studies in accepted aSa sole minor. With the written approval of the department adviser, other subjects may be substituted. No courses will satisfy minor requirements if they are excluded from the majors of their departments except French 103, 104, German 103, 104, Latin 101, 102, 103, Portuguese 103, 104, Russian 103, 104, and Spanish 103, 104. Foreign language department courses presenting foreign literature in translation are also excluded.

Departmental Honors Program and Distinction: A student majoring in rhetoric and composition who meets the University grade-point requirement (4.0 or higher) may earn distinction only by completing nine hours of honors work in addition to the minimum of hours required for his major. This additional credit must involve a significant writing project in Rhetoric 255, the completion of English 297, and any two of the following three honors courses: English 197, 295, 296. The level of distinction (Distinction, High Distinction, Highest Distinction) is determined by the instructors in charge of the courses and the Honors Committee. If, in the opinion of his instructors and the committee, a candidate has not earned distinction, he may still receive credit for the course.

103. **Writing Laboratory.** Individual conferences on writing problems. Prerequisite: Registration in Rhetoric 101 or 102, or in verbal communications. 1 hour. May be repeated for a total of 2 hours.
105. **Principles of Composition.** Study of the methods of exposition, the problems of argument, the use of evidence, and style. Practice in writing with primary emphasis on exposition. This course fulfills the campus rhetoric requirement. 4 hours.
108. **Forms of Composition.** Practice in writing, with emphasis on exposition. An examination of verbal and nonverbal composition. Specific topics to be announced. This course fulfills the campus rhetoric requirement. 4 hours.
133. **Principles of Composition.** Practice in exposition, with emphasis on organization, paragraphing, sentence structure. For the student whose career will require competence in writing clear, precise prose as an adjunct to other professional activity. Credit is not given for Rhetoric 133 in addition to Rhetoric 143. Prerequisite: Rhetoric 102 or equivalent. 3 hours.
143. **Intermediate Expository Writing.** Practice in expository types, with emphasis on style and critical analysis. Recommended for rhetoric majors. Credit is not given for Rhetoric 143 in addition to Rhetoric 133. Prerequisite: A grade of "A" or "B" in Rhetoric 102 or equivalent, or consent of instructor. 3 hours.
144. **Narrative Writing.** Practice in description, narrative sketches, stories. Prerequisite: Rhetoric 102 or equivalent; sophomore standing. 3 hours.
145. **Poetry Writing.** Practice in the writing of poetry; experimenting with a number of fixed forms and free verse, but emphasizing mainly the student's freedom to develop a personal style. Prerequisite: Rhetoric 102 or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Remedial Writing.** This course cannot be included in the thirty hours of advanced credit required by the College of Liberal Arts and Sciences. Prerequisite: Rhetoric 102 or equivalent, and failure on the qualifying examination in English. 3 hours.
202. **Communications Workshop.** Independent writing projects and examination of literature as the cultural basis of the student's specialized fields. 3 hours.
205. **Advanced Narrative Writing, I.** Practice in the writing of fiction, with emphasis on the short story. Prerequisite: Rhetoric 144 or equivalent. 3 hours.
227. **Advanced Expository Writing.** Types of nonfiction prose, including the essay, criticism, biography, and historical writing. Prerequisite: Rhetoric 133 or 143, or consent of instructor. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Speech 263, Theatre 280, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.

305. **Advanced Narrative Writing, II.** Continued practice in the writing of fiction, with emphasis on the longer story and novelette. Prerequisite: Rhetoric 205. 3 hours.
306. **The Writing of Poetry.** The practice of the writing of poetry aided by intensive study of examples. Prerequisite: Rhetoric 145, junior standing and six hours of English literature, or consent of instructor. 3 hours or 3/4 unit. This course may be repeated for credit to a maximum of 6 hours.
355. **Creative Writing.** Personal direction in a writing project: fiction (novel or short stories), drama, poetry, criticism, nonfiction narrative, etc. Frequency of conference to be determined by the type of project. Students must see the instructor during the first week of classes to arrange a conference schedule. Prerequisite: A preparatory course in advanced writing (Rhetoric 205, 206, 227, 330; or Speech 263, 363) and written consent of the instructor with whom the student will be working or of the Director of Advanced Rhetoric if the instructor is not available. 2 hours. May be repeated for credit to a maximum of 4 hours, but these 4 hours may not be taken concurrently with another course in the same kind of writing. (For example, a student electing fiction in Rhetoric 255 may not register in Rhetoric 206 in the same semester.)
400. **Verbal Communication in English as a Second Language for Graduate Foreign Students, I.** A language laboratory course concentrating on the typical writing problems that a graduate or research student encounters in an American university. Prerequisite: Rhetoric 111 or consent of instructor. 0 to 4 hours. No graduate credit.
401. **Verbal Communication in English as a Second Language for Graduate Foreign Students, II.** A language laboratory course dealing with individual, immediate and specialized speaking and writing problems, with particular attention to orienting the graduate student to the techniques of the American university in thesis and other specialized writings and in the oral presentation of such material. Prerequisite: Rhetoric 400 or consent of instructor. 0 to 4 hours. No graduate credit.
419. **Contrastive Linguistics.** Same as Linguistics 419. A critical survey of contemporary linguistic models with special reference to their relevance in preparing contrastive analyses of languages; detailed discussion on contrastive analyses of English and selected non-western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. 1/2 or 1 unit.

English as a Second Language

109. **English as a Second Language.** An intensive course in basic English structure for foreign students who are inadequately prepared for either Rhetoric 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions: recommendation from Illinois placement test. No credit.
110. **English as a Second Language.** A study of the sounds and intonation patterns of American English and the relation of sound to spelling, designed to improve the student's ability to speak and understand English at normal conversational speed. May also be taken with Rhetoric 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test, or consent of instructor. No credit.
111. **English as a Second Language.** Continuation of Rhetoric 109. A rapid and intensive review of basic English structure and a study of more complicated sentence patterns with practice in simple oral and written composition. Designed for students inadequately prepared for Rhetoric 114. Prerequisite: Rhetoric 109, recommendation from Illinois placement test, or consent of instructor. No credit.
114. **Composition for Undergraduate Foreign Students.** Oral and written composition and reading for students whose native language is not English. Prerequisite: Rhetoric 111, recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.

- 115. Composition for Undergraduate Foreign Students.** Continuation of Rhetoric 114. Students who receive a grade of "C" or "D" in Rhetoric 115 must take the qualifying examination in English for foreign students; those who receive the grade of "fail" on this examination must take Rhetoric 201. Rhetoric 114 and 115 fulfill rhetoric requirements for foreign students. Prerequisite: Rhetoric 114 and/or recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.
- 201. Composition for Undergraduate Foreign Students.** This course does not count for advanced hours toward graduation. Prerequisite: Rhetoric 114 and 115 and failure on the qualifying examination in English for foreign students. 3 hours.
- 379. American Language and Literature.** A noncredit course to develop facility in the English language through a study of American literature and culture. Open to any foreign student who has completed Rhetoric 109, 110, and 111, or who was not required to take these courses. No credit.
- 388. Linguistics in Language Learning, I.** Same as Linguistics 388. The application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or 3/4 unit.
- 389. Linguistics in Language Learning, II.** Same as Linguistics 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the application of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or 3/4 unit.

Business and Technical Writing

- 251. Business and Administrative Communication.** A study of communication as a tool of administration and management. Practice in writing a wide variety of types and forms of communication. Oral and visual communication are included with the written to provide an integrated approach. For the student whose career will be in administration and management requiring a broad range of communication skills. Prerequisite: Fulfillment of the campus rhetoric requirement. 3 hours.
- 271. Sales Writing.** Same as Advertising 288. Direct mail campaigns and company magazine copy. Prerequisite: Rhetoric 102 or equivalent. 3 hours.
- 272. Report Writing.** Personal direction in a report writing project which can be integrated with research in another course. Study of report writing principles and practices. Classes meet for the first month after which the student and the instructor arrange a conference schedule. Small group meetings are arranged for presentation of proposals, progress reports, and summary reports. Prerequisite: Fulfillment of campus rhetoric requirement. 3 hours.
- 293. Independent Study.** Independent research with a chosen tutor leading to the writing of a formal report or preparation of some other type of major presentation of information. Prerequisite: Completion of the campus freshman rhetoric requirement. 3 hours.

Entomology

(See Life Sciences)

FINANCE

Acting Head of Department: Professor J. W. LEONARD

Department Office: 340 Commerce Building (West)

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in finance. A finance major who chooses economics as a minor must include also twelve hours in a second minor.

Economics 108, or Economics 102 and 103, are fundamental courses in economics, and are prerequisites for courses in finance. Students who expect to do advanced work in finance should take Economics 108 or Economics 102 and 103 in their sophomore year. Liberal arts majors in finance are advised strongly to elect Accountancy 201 and a course in statistics.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, economics, geography, geology, history, law, mathematics, philosophy, political science, psychology, sociology. The curriculum in Latin-American studies is accepted as a minor.

150. **Money, Credit, and Banking.** A study of monetary and banking systems and the impact of monetary policy on employment, prices, economic growth, and international trade. Prerequisite: Economics 103 or 108. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
252. **Banking Practice in the United States.** A study of the functions, operations, policies, organization, management, and supervision of banks. Prerequisite: Finance 150 and 254. 3 hours.
253. **Investment Banking.** Role of investment banking in the financial organization; investment banking houses; relation of investment banking to other financial institutions; regulation of investment banking and the security markets; current problems and developments in investment banking. Prerequisite: Finance 150 and 254. 3 hours.
254. **Introduction to Business Financial Management.** The development and study of a decision framework for financial management; an introduction to the analysis of past and future needs; an analysis of the management of short-term assets; an introduction to a decision framework for capital investment management with an analysis of the cost and sources of long-term capital. This course integrates the concepts of financial management into a total systems approach to business decision making. Prerequisite: Accountancy 105 or 201; credit or registration in Economics 172. 3 hours.
255. **Financing Corporate Consolidation and Reorganization.** The financial aspects of industrial concentration; the combination movement; financing complex corporate enterprises; financial phases of reorganization; the reorganization process. Prerequisite: Finance 254. 3 hours.
257. **Corporation Finance.** A study of the character of corporations; corporate securities; acquiring capital; internal financial control; expansion and intercorporate relations; and corporate capital readjustments. For non-commerce students only. Credit is not given for both Finance 257 and 254. Prerequisite: Economics 103 or 108. 3 hours.
258. **The Money Market and American Financial Institutions.** A study of the development and the practices of specialized financial institutions in the United States: commercial banking; central banking; savings banks; trust companies; investment banking; real estate finance; agricultural finance; government financial institutions. Prerequisite: Economics 103 or 108. 3 hours.
259. **Investment.** Economics of investment; fundamental principles of financial investment; investment media or instruments; portfolio composition and management for individual and institutional investors. Prerequisite: Economics 103 or 108. 3 hours.
260. **Economics of Insurance.** A survey course in the field of insurance to serve as a common introductory course to the fire, marine, casualty, surety, and life branches of the insurance business. Prerequisite: Economics 103 or 108. 3 hours.

262. **Life Insurance.** A study of the life insurance industry, companies, products, and markets. Prerequisite: Economics 103 or 108. 3 hours.
294. **Senior Research.** A research and reading course for students concentrating in finance, insurance, urban land economics, or related areas, who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better, (2) have attained Honors Day recognition in the junior year, or (3) have consent of instructor. This course may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
295. **Senior Research.** A research and reading course for students concentrating in finance, insurance, urban land economics, or related areas, who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better, (2) have attained Honors Day recognition in the junior year, or (3) have consent of instructor. This course may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
340. **Consumer Finance.** Nature and importance of consumer finance; trends in consumer credit; instruments and institutions of consumer credit; economic effects of consumer finance; consumer credit and public policy. Prerequisite: Economics 102 or 108; Finance 150 and 254; or consent of instructor. 3 hours, or 1/2 to 1 unit.
350. **Capital Investment Management.** Designed to develop an understanding of the complex problems related to financial management; the development of an analytical framework for capital investment decision making; the study of capital investment problems through the use of selected cases. Prerequisite: Finance 254. 3 hours, or 1/2 to 1 unit.
357. **Financing Small Business.** Size and nature of small business; significance and limitations of small business; financial structure and problems; financial assistance to small business; future prospects of small business. Prerequisite: Finance 254 or 257. 3 hours, or 1/2 to 1 unit.
359. **Securities Analysis.** Portfolio selection in theory and practice; application of analytical principles and techniques to fixed income securities, common stocks, and senior securities with speculative features; efficient income/risk selection of securities. Prerequisite: Accountancy 108; Finance 254. 3 hours, or 1/2 to 1 unit.
360. **Employee Benefit Plans.** Same as Labor and Industrial Relations 360. An analysis of the economic and financial issues involved in designing and administering employee benefit plans. Major emphasis is given to group life, disability income, and medical care plans and to "qualified" pensions and profit-sharing plans for regular employees. Some attention is given to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Industrial Administration 351, or consent of instructor. 3 hours, or 1/2 to 1 unit.
363. **Seminar in Life and Health Insurance.** A seminar devoted to discussions of current financial, legal, and social problems involving life and health insurance. Legal and financial problems involving life and health insurance product development, life and health insurance in estate planning, government regulation of the life insurance industry, and the economic aspects of the industry are discussed. 3 hours, or 1/2 to 1 unit.
364. **Fundamentals of Real Estate and Urban Economics.** Determinants of growth and development; survey of problems affecting land resource allocation: transportation, poverty, employment, public finance, and housing. Introduction to systems analysis, cost-benefit, and cost-effectiveness studies, real estate market forecasting, appraising, economic base analysis, financing, construction, land use controls. Prerequisite: Six hours of economics and a course in political science or sociology, or consent of instructor. 3 hours, or 1/2 to 1 unit.
365. **Urban Land Investment Analysis.** Provides an analysis on framework for urban real estate investment decisions by individuals and institutions. Exposition of rate-of-return analysis is illustrated by actual investment situations. The Determinants of Real Estate Investment policy for borrowers and lenders requires consideration of mortgage markets, government policies, risk controls, and analysis of different types of real estate investments. Prerequisite: Finance 364 or consent of instructor. 3 hours, or 1/2 to 1 unit.

366. **Valuation Theory and Methods.** Concentrates on land value theory and methods. The primary concern is the selection of a valuation theory which produces an ethical valuation as needed by buyers, sellers, lenders, the government, insurers, etc. The role of the appraiser as evaluator, expert witness, and counselor. Uses case method to demonstrate principles and practices. Prerequisite: Finance 364 or consent of instructor. 3 hours, or 1/2 to 1 unit.
367. **The Urban Public Economy.** Same as Economics 361. An economic analysis of public policy with respect to urban problems. A full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land use controls pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or 1/2 or 1 unit.
370. **Risks and Risk Management.** Analysis of the financial problems in the risks of property damage or bodily injury (in business situations), and evaluation of the alternative methods for dealing with such problems. Prerequisite: One of the following: Accountancy 105 or 201, or Finance 254 or 257; Economics 103 or 108. 3 hours, or 1/2 to 1 unit.
371. **Seminar in Property and Liability Insurance.** A seminar devoted to discussions of current financial, legal, and social problems involving property-liability insurance. Legal problems involving insurance coverages, financial aspects, and governmental regulation of the property-liability insurance enterprise, and economic aspects of the insurance industry, are analyzed. 3 hours, or 1/2 to 1 unit.
420. **Central Banking Policy.** An examination of modern theories of monetary management, gold standard theories, central banking, fiscal policy, debt management, and their relation to monetary policy. 1 unit.
425. **The Money Market and Financial Stabilization.** A study of interest rate determination; the structure and operations of the money and capital markets; the objectives and implementation of monetary, fiscal, and debt management policies. Prerequisite: Finance 150. 1 unit.
427. **Research Seminar in Banking.** Research is reported and explored in the areas of commercial bank models and behavior, bank structure and regulation, and central bank control. In addition, current topics, specialized areas in banking, and research procedures are discussed by instructor, students, and guest lecturers. Prerequisite: One semester of graduate economic theory; Economics 470. 1 unit.
450. **Theory of Financial Management.** The objective of this course is to develop an analytical framework which represents the underlying theory of finance and its interrelationship to the total system within the firm. Necessary to this approach is the development of a perspective for both internal and external approaches to financial management. Prerequisite: Finance 254 or equivalent; Mathematics 132 or equivalent; Economics 470 or equivalent. 1 unit.
452. **Investment Behavior.** Investment behavior is examined by mathematical, statistical, and behavioral science models. The models provide the basis for analyzing portfolio selection, capital market price behavior, financial institution investment behavior, and stock price behavior. Prerequisite: Mathematics 134 or equivalent; Economics 470 or equivalent. 1 unit.
454. **Corporation Finance.** Nature of corporation finance and its relation to economics, accounting, and law; development of business corporation; concepts of capital, capitalization, and capital stock; nature of equities in corporation; financial analysis and interpretation; nature and development of financial plans; corporate securities and their adaptation to financial plan; initial and promotional financing; current capital financing; income administration; refinancing. Prerequisite: Finance 254. 1 unit.
455. **Corporation Finance.** Expansion; consolidation, concentration, and intercorporate relations; the corporate institution and the problem of monopoly and competition; corporate failure and reorganization; corporate financial management and the economy. Prerequisite: Finance 254. 1 unit.

- 456. Investment.** A study of the financial process by which savings are transformed into capital; theories of investment value and of portfolio composition; critique of individual and institutional portfolio policies; survey of investment literature. 1 unit.
- 460. Theory of Insurance.** A study of the nature and cost of risk in our economic society and of the methods of handling it. 1 unit.
- 468. Studies in Urban Economics: Environment and Land Use.** Economic forces and policies affecting location, growth, and economic base of the city. Consideration of problems affecting urban resource allocation and location: housing, transportation, ecology, segregation, public finance, strategies in community development, consideration of theories, and methods of analysis of effective urban resource allocation and valuation. Graduate students should consult with the instructor as to whether Finance 364 or this course is preferable. 1 unit.
- 469. Problems and Policies in Urban Economics.** Urban development and the national economy; interaction of business institutions and public agencies in performance of urban functions; determinants of land-use patterns; economic aspects of property rights and land-use controls; unmet needs. Students undertake intensive analysis problem selected for individual study. Cooperation with urban planning, architecture, landscape architecture, and other departments. Prerequisite: Finance 364 or 468, or consent of instructor. 1 unit.
- 470. Risk Management and Control.** Same as Business Administration 555. An analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses, techniques for risk and loss control, models for risk management decision-making, and procedures for administering risk management policy relating to non-speculative (insurable) risk. 1 unit. Prerequisite: Business Administration 552 and 560, or equivalent, or consent of instructor. 1 unit.
- 490. Individual Study and Research.** Directed reading and research. 1/2 to 1 unit.
- 499. Thesis Research.** Required for those writing master's and doctor's theses in finance. 0 to 4 units.

FINE AND APPLIED ARTS

Program Administrator: Professor R. P. LINK

Office: 114 Architecture Building

- 100. Language and Design, I.** Comprehension of systems, analysis, methods of verbal and visual aspects of communication and design emphasizing practical application to a professional career. Primarily for freshman and sophomore members of the Special Educational Opportunities Program in architecture, art, urban planning, and landscape architecture. 0 to 6 hours.
- 101. Language and Design, II.** Continuation of Fine and Applied Arts 100. Prerequisite: Fine and Applied Arts 100. 0 to 6 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 299. F.A.A. Study Abroad.** Provides campus credit for foreign study and/or travel. A detailed proposal for study abroad must be submitted for approval by the appropriate committee of the department in which the student is studying and the office of the Dean of the College of Fine and Applied Arts prior to such study abroad. Final determination of credit and its application toward the degree is made after a review of the student's work abroad by the above committee and college office. Prerequisite: Junior standing in the department and approval of the student's proposal by the departmental committee and the college office. 0 to 12 hours (summer session, 0 to 6 hours).

FOOD SCIENCE

Head of Department: Professor A. J. SIEDLER

Department Office: 567 Bevier Hall

101. **Food in Modern Society.** The importance of food in providing adequate nutrients for modern society is stressed. An introduction is given to processing and preservation of foods as well as the historical, geographical, chemical, and microbiological ramifications which exist in the food industry. 3 hours.
202. **Sensory Evaluation of Foods.** The physiology, psychology, and chemistry of flavor and flavor perception; tactual, visual, and auditory components affecting food acceptability; principles and application of Preference and Discrimination testing; interpretation of panel evaluation data. 3 hours. TOBIAS.
206. **Inspection Trip.** Inspection of typical examples of food preservation and manufacturing plants. A three- to four-day trip required of all seniors; estimated cost, \$35.00. Prerequisite: Junior standing in food science or consent of department. No credit.
213. **Food Analysis, I.** Principles and application of the chemical methods used to determine the major and minor constituents of foods; physical measurements applied to foods; special considerations applicable to the analysis of certain foods. Prerequisite: Chemistry 102. 3 hours. TOBIAS.
214. **Survey of Food Chemistry.** The chemical composition of foods and the chemistry of the processing of meats, vegetables, fruits, milk, and cereals. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 102. 3 hours. WHITNEY.
260. **Raw Materials for Processing.** Lectures, reference readings, and laboratory experiments concerning the problems involved with procurement, harvesting, handling, and storage of fruits, vegetables, cereal grains, dairy products, and meat for the food processing industry. Field trips to specialized operations. Prerequisite: One course in biological science and Food Science 101, or consent of instructor. 4 hours. NELSON, WEI.
300. **Special Problems.** Supervised research on special problems in food science and dairy technology. Prerequisite: Written consent of instructor must be obtained prior to enrollment. This course is not open to undergraduates who are on probation. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or 3/4 to 1 1/2 units.
301. **Food Processing.** Principles and application involved in canning, freezing, dehydrating, flour milling, luncheon meats, freeze drying, and plastic films. Field trips to food processing and manufacturing operations. Prerequisite: Food Science 202, 213, 260, or consent of instructor. 5 hours or 1 1/4 units. NELSON, WEI.
308. **Food Plant Management.** Problems in the organization, financing, labor management, and operation of food plants. Prerequisite: Senior standing or consent of instructor. 3 hours or 3/4 unit. WILSON.
310. **Dairy Product Processing.** Theory and practice in procurement of milk, separation and creaming phenomena, homogenization, heat treatment; concentrating, drying, and freezing as applied to fluid milk products, cultured milk products, concentrated and dried milk products, ice cream, butter, and cheese. Prerequisite: Food Science 213 and 260, or consent of instructor. 5 hours or 1 1/4 units. HETRICK.
313. **Food Analysis, II.** Laboratory exercises, demonstrations, and assigned readings dealing with the application of analytical chemical and instrumental techniques to the analysis of food constituents. Prerequisite: Chemistry 122 or Food Science 213, or equivalent. 3 hours or 3/4 unit. PERKINS.

314. **Food Chemistry, I.** The major chemical components of foods, lipids, carbohydrates, and proteins, and the chemical changes that occur during processing and storage. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 131 and 134. 3 hours or 3/4 unit. WHITNEY.
315. **Food Chemistry, II.** The minor chemical components of food: vitamins, pigments, salts, trace elements, and enzymes, and the changes that occur in them during processing and storage; the physical and colloidal properties of foods; food additives and contaminants; metabolism of foods. Prerequisite: Food Science 314. 3 hours or 3/4 unit. WHITNEY.
324. **Problems in Nutrition.** Same as Home Economics 324. Discussions and investigations. Prerequisite: Biochemistry 350 and 355 or 354 and 356; Home Economics 220; senior standing. 3 to 5 hours, or 1/2 or 1 unit. HASKELL.
332. **Principles of Sanitation in the Processing and Handling of Foods.** A study of the principles of sanitation with appropriate emphasis on practical considerations as they apply to various food processing industries; control of insects, rodents, and microorganisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods; government and public health regulations. Field trips to local food processing plants. Prerequisite: Microbiology 100 and 101; Chemistry 102. 2 hours or 1/2 unit. ORDAL, WITTER.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypothesis with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or 3/4 unit. SEIF.
363. **Introduction to Process Engineering.** Fundamentals of heat transfer, fluid flow, evaporation, drying, and other unit operations in the process industries. Prerequisite: Calculus or consent of instructor. 3 hours or 3/4 unit. STEINBERG.
373. **Advanced Food Microbiology.** A study of the microbiology of those foods, food processes, or food ingredients the production of which involves the biological or enzymatic activities of bacteria, yeasts, or the higher fungi. Prerequisite: Chemistry 133; Microbiology 311 and 312. 5 hours or 1 1/4 units. Offered in 1973-1974 and in alternate years. ORDAL, WITTER.
391. **The Chemistry of Lipids in Foods.** A detailed survey of the chemical and physical properties of lipids. Prerequisite: Biochemistry 350 or consent of instructor. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years. PERKINS.
404. **Technology of Fats and Oils.** A study of the commercial technology of fats and oils, including soaps and protective coating. Prerequisite: Food Science 391 or consent of instructor. 1/2 unit. Offered in 1972-1973 and in alternate years.
406. **State and Metabolism of Lipids.** An advanced study of the state of lipids in animal tissues and in biological fluids, and of the metabolism of lipids in relation to dietary fats and other food constituents. Prerequisite: Chemistry 350 or consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years. NISHIDA.
421. **Seminar.** Discussions on specialized topics and current literature relating to food science. Required of all graduate students in food science. 1/4 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Food Science 340 or equivalent. 3/4 unit.
499. **Thesis Research.** 0 to 4 units.

FORESTRY

Head of Department: Professor W. R. BOGGESE

Department Office: 219 Mumford Hall

100. **Farm Forestry.** This course should be particularly helpful to all students in general agriculture, including agricultural extension, soil conservation, and teacher-training majors. A study of those phases of forestry which are applicable on Illinois farms. Includes identification of the principal trees; identification, properties, and uses of common woods; harvesting and marketing of principal products of farm woodlands; preservative treatment of farm timbers; measurement of logs, trees, and stands; determination of growth rate and value; life history of the forest and silvicultural handling of woodlands, including the care of growing forests and the selection of trees for harvest; natural reproduction of forests and tree planting for wood products, erosion control, and windbreaks; protection of woodlands; place of farm woodlands in the agricultural economy; public aids to woodland owners; and educational programs for youth and adults. Prerequisite: Enrollment in College of Agriculture, College of Education, or consent of instructor. 3 hours.
101. **General Forestry.** The forest as a renewable natural resource; the aims and scope of forestry; economic and social importance of forests to the nation; the principal forest regions and species; forests for timber supply, for water conservation, for recreation, and for wildlife; the principles of forest management and protection; the development of public and private forestry in the United States; forestry as a profession. Prerequisite: Enrollment in a forestry curriculum or sophomore standing. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours.
200. **Special Problems.** Supervised research on special problems in forestry. Prerequisite: A minimum grade-point average of 3.75; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 3 hours.
211. **Forest Ecology (Summer Field Studies).** A field study of the structure and dynamics of forest ecosystems and the effects of management on those systems. Prerequisite: Botany 100 and Zoology 104, or one year of biology; registration in summer field studies. 3 hours.
213. **Silviculture.** The art and science of controlling forest establishment, composition, and growth that will best fulfill the objectives of the owner. Prerequisite: Forestry 211. 3 hours.
220. **Dendrology.** The taxonomy, geographical distribution, economic importance, and elementary silvics of the important forest trees in the United States and Canada. Prerequisite: Botany 100. 4 hours.
221. **Introduction to Forest Measurements (Summer Field Studies).** An introductory course designed to acquaint the student with the methods and problems of measuring forest areas, trees, and forest products, with emphasis on field work; includes elementary work on tree measurement and volume; board measure; scaling; and the location, mapping, and inventory of forest properties. Prerequisite: Registration in summer field studies. 3 hours.
222. **Advanced Forest Measurements.** Continuation of Forestry 221. Introduction to statistics and statistical methods in forest mensuration; principles and methods of volume and growth estimation and forest inventory. Prerequisite: Forestry 221; Agronomy 340. 3 hours.
231. **Wood Utilization (Summer Field Studies).** Field and class exercises in logging, milling, equipment maintenance, and use; the industrial aspects of wood use. Prerequisite: Registration in summer field studies. 2 hours.

232. **Wood Utilization.** Principles, methods, and costs of harvesting, grading, and transporting forest products; conversion of logs, bolts, and cordwood; the physical-mechanical properties and defects of wood; specifications and uses of lumber, veneer, plywood, pulp, paper, and chemical derivatives. Estimated cost of one-day field trip, \$3.00. Prerequisite: Forestry 231. 3 hours.
234. **Wood Seasoning.** The theory and practice of seasoning wood; the relation of moisture to wood properties; methods of drying wood and their application are considered. Prerequisite: Forestry 271 or consent of instructor. 2 hours.
242. **Forest Resources Management.** Concepts, techniques, and management tools applied to forest properties managed for continuous production of timber and other forest products; determination of optimum rotation and growing stock; appraisals, taxation, and management planning. Prerequisite: Forestry 222; senior standing. 4 hours.
253. **Forest Economics.** Concepts of economic supply of, and demand for, the major wood products; trends in wood products consumption and prices and the major marketing problems; prospects for future development of U.S. wood products industries and trade. Prerequisite: Economics 108. 3 hours.
260. **Forest Land Policy and Administration.** Forest land policies and their administration with emphasis on the relations among resources, politics, and people; current major problems in forest land policy administration and progress toward their solution. Prerequisite: Economics 108 or consent of instructor. 3 hours.
271. **Wood Anatomy and Identification.** A study of the macroscopic, microscopic, and ultramicroscopic structure of wood and the identification of many important commercial woods by means of anatomical characteristics; fundamental physical and chemical properties of wood. Prerequisite: Enrollment in forest science or wood science curricula, or consent of instructor. 3 hours.
272. **Physical and Mechanical Properties of Wood.** The physical properties of wood, emphasizing the influence of anatomy, density, moisture content, and wood-liquid relations; introduction to the mechanical properties of wood, including stress-strain relationships and standard methods of timber testing; the effects of defects, specific gravity, moisture content, and other factors on the strength of wood, particularly beams and columns. Prerequisite: Forestry 271, Theoretical and Applied Mechanics 171 and 172, or consent of instructor. 3 hours.
273. **Adhesives and Laminates.** Physical and chemical properties of the principal adhesives used to bond wood and other materials; principles of adhesion; manufacture, properties, and uses of plywood, laminated wood, and other products. Prerequisite: Enrollment in the wood science curriculum or consent of instructor. 3 hours.
274. **Wood Preservation.** The theory and application of wood preservation; agencies causing deterioration of wood and their control; fire retardants, treating chemicals, and processes. 3 hours.
275. **Seminar in Wood Science.** Individual problems in the field of wood technology and utilization chosen by the student. Each problem involves library studies, verbal reporting, and group discussion. Prerequisite: Junior or senior standing in the wood science curriculum. 2 hours.
316. **Environment and Tree Growth.** Growth and development of forest trees as related to environmental factors, with special emphasis on micro-site changes induced by silvicultural practices. Completion of a special project required for graduate credit. Prerequisite: Forestry 211 or consent of instructor. 4 hours or 1 unit.
319. **Environment and Plant Ecosystems.** Same as Agronomy 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes. The physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels are discussed in basic language. Prerequisite: One course in organic chemistry or equivalent, or consent of instructor. 3 hours or 3/4 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Sci-

ence 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analysis of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or 3/4 unit.

362. **Forest Entomology.** A study of the characteristics, life histories, and forest relationships and controls of the economically important forest insects of the United States. Prerequisite: One year of biological science and one year of chemistry. 3 hours or 3/4 unit.
400. **Seminar.** Discussions on specialized topics and current literature in forestry. Required of all graduate students in forestry. 1/4 unit. May be taken twice for a total credit of 1/2 unit.
401. **Special Problems.** Individual studies or investigations in selected branches of forestry. 1/2 to 1 unit. Not more than 2 units may be offered toward an M.S. degree.
414. **Discussions in Forest Ecology and Physiology.** Individual and group discussions of developments and techniques in forest ecology and physiology based on classic and current literature. Prerequisite: Consent of instructor. 1/4 unit. Total credit limited to 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Forestry 340 or equivalent. 3/4 unit.
460. **Discussions in Forest Policy and Administration.** Individual and group discussions of the major relevant problems in the field of forest resources policy and administration, both public and private, based on current literature. Prerequisite: Consent of instructor. 1/4 unit. Total credit limited to 1 unit.
499. **Thesis Research.** Research may be conducted in various phases of forestry. Subject must be approved by departmental committee. 1 to 3 units.

FRENCH

Head of Department: Professor B. H. MAINOUS

Department Office: 2090 Foreign Languages Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours beyond the prerequisites French 201, 211, 213, or their equivalent and excluding all 100-level courses and French 202, 203, 218, 255, 256, and 282, and including courses as outlined by options below. The course French 199 may be included if approved by the departmental major adviser. In the course of three of his last four semesters of undergraduate study the student reads the works on a departmental reading list, with the guidance of a tutor, normally repeating enrollment for one hour per semester for a total of three hours of credit.

Option I: Literature

1. Two courses must be selected from each of the following areas: French literature to 1800; French literature from 1800 to the present; and French language, linguistics, or civilization.

2. French 295, 3 hours.

Option II: Language and Linguistics

1. Four courses in French language, linguistics, or civilization.

2. One course from each of the following: French literature to 1800 or French literature from 1800 to the present.

3. French 295, 3 hours. Students taking this tutorial who may pursue graduate studies should add one more literature course to their programs.

Note: The major in French is strongly advised to take a year's work in European history and a year's work in English or American literature.

Minors: Twenty hours in not more than two of the following subjects, excluding the first two semesters of modern foreign language and Rhetoric 101 and 102, with at least eight hours in each subject if two are chosen: education, English, German, Greek, history, humanities, Italian, Latin, library science, linguistics, medieval civilization studies, philosophy, Portuguese, Russian, Spanish, or an approved sequence in history of architecture, history of art, or music, not including applied music, combined with any one of the above subjects. With the written approval of the department adviser, other subjects may be substituted.

Year Abroad Program: A year abroad program in France is sponsored by the University of Illinois. It constitutes the equivalent of a year of residence on the American campus and provides thirty credit hours of upper-level courses in French literature, language, and civilization, with the possibility of credit in other fields. A student need not be a French major to apply. For further information concerning prerequisites and application procedures, students should inquire at the office of the Department of French.

Departmental Distinction: Students interested in attaining departmental distinction must take a special program of study and must make application at least one year prior to graduation. The English and history courses recommended for the major are normally expected of students working for distinction. Interested students should contact the Department of French office, 2090 Foreign Languages Building, for information.

100. **Preparatory French.** An introduction to the nature of language and its relation to the study of French, the values of foreign language study, and the methods of foreign language study, as well as an introduction to French language and culture. 3 hours.
101. **Elementary Course.** Grammar, pronunciation, reading of modern authors, composition, conversation. For students who have had no work in French. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **Elementary Course.** Continuation of French 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: French 101 or one year of high school French. 4 hours.
103. **Modern French.** Reading of modern authors. Conversation and pronunciation. Syntax and some composition. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
104. **Modern French Literature and Civilization.** Continuation of French 103. Reading of modern authors and an introduction to French civilization; some syntax and composition; conversational practice. Completion satisfies graduation requirements in the College of Liberal Arts and Sciences. Students planning to take advanced French courses are to take French 134 in lieu of French 104. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
105. **Intensive Elementary French.** This course is equivalent to French 101 and 102. Oral comprehension, speaking, reading and writing skills, approached by the audiolingual method, and some reading of literary texts. For students who have had no previous French and who want to learn at a rapid rate. All students in this course are required to register for two hours of work weekly in the language laboratory. 8 hours.
106. **Intensive Elementary and Intermediate French.** Combines French 102 and 103 for students having attained 101 proficiency and who wish to advance more rapidly. Prerequisite: French 101 or equivalent, or a placement score showing high school achievement equivalent to French 101. 8 hours.
107. **Intensive Intermediate French.** Combines French 103 and 104 for students having attained 102 proficiency and who wish to advance more rapidly. Prerequisite: French 102 or 105. 8 hours.
113. **Conversational Practice.** Oral practice for the development of elementary conversation-

- al skill and the improvement of pronunciation. Designed as a supplement to French 103, 104, and open only to students concurrently enrolled in either French 103 or 104. Prerequisite: French 102 or two years of high school French. 1 hour.
114. **Conversational French.** Practice in spoken French. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. Does not serve as a prerequisite for advanced courses in French without departmental approval, which usually requires a proficiency examination at the 104 level. Prerequisite: French 103, 123, or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
123. **Readings in French Literature.** Readings in French literature (texts in French with discussion in English). Some grammar essential to development of reading skill. Additional readings in English of authors treated will be assigned according to demonstrated interest. Serves as prerequisite to French 124. Students planning to take advanced French courses should enroll in French 133. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
124. **Readings in French Literature.** Additional readings in English of authors treated will be assigned according to demonstrated interest. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. Does not serve as a prerequisite for advanced courses in French without departmental approval, which usually requires a proficiency examination at the 104 level. Prerequisite: French 103; French 123; placement by virtue of high school units (usually three years). 4 hours.
133. **Accelerated Modern French.** Same as French 103, but accelerated for those interested in pursuing French in advanced courses. Prerequisite: French 102, two semesters of college French, or a placement score showing high school achievement equivalent to French 102. Normally for students with a "B" average in French or with consent of instructor. 8 hours.
134. **Accelerated Modern French Literature and Civilization.** Reading of major French writers from several centuries and introduction to French civilization, syntax, and composition, conversational practice. An accelerated course for those intending to take advanced courses in French. Prerequisite: French 133, or French 103 with department approval, or three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 8 hours.
144. **France and the French in the Twentieth Century.** Contemporary French life and institutions reflected in modern writing. Some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. Does not serve as a prerequisite for advanced courses in French without departmental approval, which usually requires a proficiency examination at the 104 level. Prerequisite: French 103, three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
154. **Contrastive Studies of French and American Culture.** Provocative commentaries on aspects of American life and institutions by contemporary French writers and intellectuals. Some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. Does not serve as a prerequisite for advanced courses in French without departmental approval, which usually requires a proficiency examination at the 104 level. Prerequisite: French 103, three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
164. **French Readings in the General Sciences.** Designed for those interested in a reading background in general scientific works. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. Does not serve as a prerequisite to advanced courses in French without departmental approval, which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.

174. **Readings in French Newspapers and Magazines.** A study of current events and contemporary French life from the reading of newspapers and magazines specially ordered from France. Requires fee of \$5.00 to cover subscription cost in lieu of text. May be substituted for French 104 to satisfy graduation requirements of the College of Liberal Arts and Sciences. Does not serve as a prerequisite to advanced courses in French without departmental approval, which usually requires examination at the 104 level. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to French Literature.** Prerequisite: French 104 or 107, or equivalent. 3 hours.
202. **Introduction to French Literature.** Continuation of French 201. Prerequisite: French 104 or 106, or equivalent. 3 hours.
203. **Selections in Contemporary French Literature.** Masterpieces of contemporary authors. Prerequisite: French 201 and 202, or equivalent. 2 hours.
207. **Studies in French Fiction.** A study of different types of narrative in French literature, with an emphasis on shorter forms. Prerequisite: French 201 or equivalent. 3 hours.
208. **Studies in French Theatre.** A critical examination of ideas and practices in the theatre and their illustration in a number of French plays. Prerequisite: French 201 and 202, or equivalent. 3 hours.
209. **Studies in French Poetry.** Methods and problems of poetic analysis; study of selected masterpieces of French Poetry. Prerequisite: French 201 or equivalent. 3 hours.
211. **Oral French.** Training for the development of oral facility; exercises for the improvement of pronunciation and diction. Practice in the language laboratory is required. Prerequisite: French 104 or 107, or 103 and 113, or four years of high school French. 3 hours.
212. **Oral French.** Continuation of French 211. Practice in the language laboratory is required. Prerequisite: French 211. 3 hours.
213. **Composition, I.** Training in writing French; translation from English and free composition. Prerequisite: French 104 or 107, or four years of high school French. 2 hours.
214. **Composition, II.** Continuation of French 213. Prerequisite: French 213. 2 hours.
215. **Intensive Composition.** Training in writing French; translation from English and free composition. Equivalent to French 213 and 214. Prerequisite: French 104 or 106, or four years of high school French. 4 hours.
217. **Advanced Oral French.** An intensive course stressing comprehension, pronunciation, diction, and fluency. Work includes conversation, oral reports, and group discussions. Required of French teacher education majors. Prerequisite: French 212. 4 hours.
218. **Conversation dirigée.** Directed conversation stressing fluency and accuracy in French through conversations, reports, and discussions specifically centered around contemporary French life and culture. May not be used to satisfy major requirements. Prerequisite: French 217 or equivalent. 2 hours.
219. **French Literature of the Middle Ages.** A survey of the major works and most important writers of the medieval period. Readings are in modern French. Prerequisite: French 201 or equivalent. 3 hours.
220. **Sixteenth-Century Literature.** A general survey of the literature of the French Renaissance. Prerequisite: French 201 or equivalent. 3 hours.
223. **French Literature of the Seventeenth Century, I.** Major French writers of the pre-classical period. Prerequisite: French 201 or equivalent. 3 hours.
224. **French Literature of the Seventeenth Century, II.** Major French writers of the classical period. Prerequisite: French 201 or equivalent. 3 hours.
227. **French Literature of the Eighteenth Century, I.** Montesquieu, Voltaire, and their contemporaries. Prerequisite: French 201 or equivalent. 3 hours.
228. **French Literature of the Eighteenth Century, II.** Diderot, Rousseau, and their contemporaries. Prerequisite: French 201 or equivalent. 3 hours.

230. **French Literature of the Nineteenth Century, I: Romanticism.** Major writers of the Romantic movement. Prerequisite: French 201 or equivalent. 3 hours.
231. **French Literature of the Nineteenth Century, II: Realism.** Major pre-realist, realist, and naturalist writers. Prerequisite: French 201 or equivalent. 3 hours.
232. **French Literature of the Nineteenth Century, III: Parnassian and Symbolist Movements.** The major poets and dramatists. Prerequisite: French 201 or equivalent. 3 hours.
233. **French Literature of the Contemporary Period, I.** Modern poetry from Baudelaire to Valéry; prose writers from 1900 to 1940. Prerequisite: French 201 or equivalent. 3 hours.
234. **French Literature of the Contemporary Period, II.** Continuation of French 233. Prerequisite: French 201 or equivalent. 3 hours.
255. **Introduction to French Literature in Translation, I.** Same as Humanities 255. A study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures are in English. Not open to students majoring in French. 4 hours.
256. **Introduction to French Literature in Translation, II.** Same as Humanities 256. A study of selected major works of French literature from the Romantic period to the present. Texts and lectures are in English. Not open to students majoring in French. 4 hours.
261. **French Abroad, I.** Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 201 and two of the following: French 211, 212, 213, 214, 215.
262. **French Abroad, II.** Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 261. 0 to 15 hours.
270. **Parateaching in French.** Parateaching prior to the practicum in local schools under the direct supervision of University of Illinois French faculty and the teaching staff of participating public schools. Prerequisite: French 212 and 214, or equivalent; permission of French teaching education adviser. 2 hours. May be repeated for credit.
275. **The Teaching of French.** Methodology for the teaching of French designed especially for a major in a field other than a foreign language. Prerequisite: French 212; enrollment in a teacher education curriculum with a minor in French. 2 hours.
282. **Teachers Course.** A survey of resources, classroom materials, standard practices, and problems in the teaching of French with practical application to actual classroom situations. Required for teacher-training majors in French. This course does not meet during the period teacher-training majors are off campus. Prerequisite: French 201 and 202, and 211 and 212, and 213 and 214, or equivalent; registration in Secondary Education 241. 2 hours.
291. **Thesis and Honors.** For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours.
292. **Thesis and Honors.** For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours.
295. **Major Tutorial.** A tutorial taken by the student in the course of three of his last four semesters of undergraduate study. Students read the works on a departmental reading list with the guidance of a tutor, repeating enrollment for a total of three hours credit, normally at the rate of one hour per semester. Prerequisite: French 201, 211, and 213, or equivalent; a declared major in French; junior standing. 1 to 2 hours.
299. **French Senior Seminar.** Studies in authors, genres, themes, and movements in French literature. Conducted entirely in French. Prerequisite: French 261 and 262 or equivalent; consent of head of department. 3 hours. May be repeated for credit.
311. **Diction.** Training in the improvement of French pronunciation, with special attention to the problems of teachers. It is recommended that French 311 and 313 be taken concurrently. Prerequisite: French 211 or equivalent. 2 hours or 1/2 unit.
313. **Phonetics.** A systematic study of the sounds and sound patterns of French. It is recommended that French 313 and 311 be taken concurrently. Prerequisite: French 212 or equivalent. 3 hours or 3/4 unit.
314. **Syntax.** An advanced theoretical and practical study of present-day French, with some

consideration of stylistics. Prerequisite: French 213 and 214, or French 215, or equivalent. 3 hours or 3/4 unit. G. LAPPREVOTTE.

315. **Stylistics.** Linguistic analysis of a variety of French prose styles to illustrate the range of expressions for the same or similar ideas. Translation into French of fairly difficult English prose; occasional directed composition. Prerequisite: French 314. 3 hours or 3/4 unit.
316. **Structure of the French Language.** Same as Linguistics 316. A general survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax. Emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or 3/4 unit. JENKINS.
335. **French Civilization, I.** A survey of French life and French institutions, intended as a background for literary studies and as a preparation for the teaching of French. Given in French. Prerequisite: French 201, 211, and 213, or equivalent. 3 hours or 3/4 unit.
336. **French Civilization, II.** Continuation of French 335. Prerequisite: French 201, or equivalent. 3 hours or 3/4 unit. LAPPREVOTTE, MAINOUS.
341. **Lectures de Proust, I: A la recherche du temps perdu.** Readings and textual explication in Marcel Proust's novel. Covers approximately the first half of Proust's novel. Prerequisite: French 201, 211, and 213, or equivalent. 3 hours, or 3/4 to 1 unit.
342. **Lectures de Proust, II: A la recherche du temps perdu.** Readings and textual explication in Marcel Proust's novel. Covers the second half of Proust's novel. Prerequisite: French 341 or consent of instructor. 3 hours, or 3/4 to 1 unit.
343. **Studies in French Literature.** Topics to be announced. Prerequisite: Junior standing. 3 hours, or 3/4 to 1 unit.
362. **Introduction to Romance Linguistics.** Same as Italian, Linguistics, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or 1/2 unit.
382. **Language Laboratory Techniques.** Same as German, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or 1/2 unit.
400. **Beginning French for Graduate Students.** Basic grammar and vocabulary; reading practice. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. 4 semester hours. No graduate credit.
401. **Reading French for Graduate Students.** Grammar, vocabulary, general and special reading. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. Prerequisite: French 400, or French 101 and 102, or equivalent. 4 semester hours. No graduate credit.
403. **The Study of Culture: Fine Arts, History, and Literature, I.** Master works studied with a special view to their presentation in foreign language programs in secondary schools and in junior colleges. Designed for students in the program for the Master of Arts in the Teaching of French. Prerequisite: Admission to the program for the Master of Arts in the Teaching of French. 1 unit.
404. **The Study of Culture: Fine Arts, History, and Literature, II.** Master works studied with a special view to their presentation in foreign language programs in secondary schools and in junior colleges. Designed for students in the program for the Master of Arts in the Teaching of French. Prerequisite: French 403 or consent of instructor. 1 unit.
405. **Techniques in Teaching College and Secondary French.** Examination and discussion of classroom procedures and language laboratory techniques in teaching French at the college and secondary level, associated with demonstration class and supervision of teaching practice. Required of new teaching assistants in the Department of French. 0 credit.

Note: In any given year a selection from the following courses is offered. For current information, consult the department office or the current semester Time Table.

425. **Explication de textes, I.** Exercises according to the method of *explication de textes*, applied to texts selected principally from the period 1944–1958. 1 unit.
433. **Studies in Sixteenth-Century French Literature, I.** Major writers of the sixteenth century studied with reference to the most important intellectual and religious preoccupations of their century. 1 unit.
434. **Studies in Sixteenth-Century French Literature, II.** Themes and techniques of major poets and poetic schools of the sixteenth century. 1 unit.
435. **Studies in Seventeenth-Century French Literature, I.** 1 unit.
436. **Studies in Seventeenth-Century French Literature, II.** 1 unit.
437. **Studies in Eighteenth-Century French Literature, I.** 1 unit. V. BOWEN, JOST.
438. **Studies in Eighteenth-Century French Literature, II.** 1 unit. V. BOWEN, JOST.
439. **Studies in Nineteenth-Century French Literature, I.** Studies in nineteenth-century literature to 1850. 1 unit. TALBOT.
440. **Studies in Nineteenth-Century French Literature, II.** Studies in nineteenth-century literature after 1850. 1 unit.
441. **Studies in Twentieth-Century French Literature, I.** In French. Twentieth-century poets and novelists. 1 unit. GRAY.
442. **Studies in Twentieth-Century French Literature, II.** 1 unit. GRAY.
443. **French Studies.** A flexible course limited only by the concentration of its material in French. May be activated by student request or faculty proposal. 1 unit.
446. **Research Methods.** Orientation in graduate research, introduction to bibliographical problems, and survey of methodology for papers and dissertations. 1/4 or 1/2 unit.
448. **Studies in French Descriptive Linguistics.** Selected specialized topics in the morphology, derivation, and syntax of contemporary standard French; topics vary each semester, e.g., verb morphology, noun derivation, interrogative systems, nominal phrases. Prerequisite: French 316. 1 unit.
449. **Introduction to Old French Language and Literature.** Training in reading Old French (twelfth and thirteenth centuries), outline of Old French grammar, reading of characteristic works, outlines of literary history. 1 unit.
450. **Historical French Grammar.** A study of the development of the French language, principally Old French from Latin. Prerequisite: French 449; an elementary knowledge of Latin. 1 unit.
451. **Studies in Medieval French Literature.** Close study of one or more topics in Old French literature. Prerequisite: Consent of instructor. 1 unit.
452. **Studies in French and Comparative Cinema.** Same as Comparative Literature 472. Historical, aesthetic, social, and technical studies of the French cinema; its development and relation to world cinema and to literature. 1 unit.
455. **History of French Literary Criticism.** Literary theory and practice of criticism as developed in France from the sixteenth to the twentieth centuries. Analysis and discussion of preoccupations, critical methods, and approaches to literature of representative critics, with emphasis upon emergence of philosophies of criticism. 1 unit.
456. **Studies in Recent French Criticism.** Study of important trends in French literary criticism of the mid-twentieth century, relating these trends to critical problems and theories of literature of the late nineteenth century and the earlier part of the twentieth century. 1 unit.
462. **Seminar in Romance Linguistics.** Same as Italian, Linguistics, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: French 362 or consent of instructor. 1 unit.
463. **College Teaching of Foreign Language.** Same as German, Russian, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, literary appreciation; the use of technology; recent experimentation. 1 unit.

467. Old Provençal
Provençal
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468. Old Provençal
with allegory
site: French
470. Seminar in
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for credit
471. Seminar in
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1 unit. Co
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473. Seminar in
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474. Seminar in
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1 unit. Co
478. Seminar in
478. Dis
literature
479. Seminar in
French
unit
481. Seminar in
German
of theories
memory
of culture
482. Seminar in
Study of
Comparative
forms.
485. Seminar in
in 1972
486. Seminar in
Officers
491. Individual
499. Thesis

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467. **Old Provençal Historical Grammar.** The phonology, morphology, and syntax of the Old Provençal language with emphasis on its Latin origins; illustrative reading of selected prose works. Lectures are in English. Prerequisite: Consent of instructor. 1 unit.
468. **Old Provençal Literature.** Selected readings of various genres, emphasizing lyric poetry, with attention to its position in European literature. Lectures are in English. Prerequisite: French 467 or consent of instructor. 1 unit.
470. **Seminar in Old French Literature.** Discussion and research on some specialized topic in Old French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
471. **Seminar in Sixteenth-Century French Literature.** Discussion and research on some specialized topic in sixteenth-century French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
472. **Seminar in Seventeenth-Century French Literature.** Discussion and research on some specialized topic in seventeenth-century French literature. Topic announced in advance. 1 unit.
473. **Seminar in Eighteenth-Century French Literature.** Discussion and research on some specialized topic in eighteenth-century French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
474. **Seminar in Nineteenth-Century French Literature.** Discussion and research on some specialized topic in nineteenth-century French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
478. **Seminar in Twentieth-Century French Literature.** Same as Comparative Literature 478. Discussion and research on some specialized topic in twentieth-century French literature. Topic announced in advance. 1 unit. Course may be repeated for credit.
479. **Seminar in French Literature.** Discussion and research on some specialized area in French literature. Topic announced in advance. Course may be repeated for credit. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as German, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, language as an aspect of culture and societal relations. Prerequisite: French 463 or consent of instructor.
482. **Seminar in French and Comparative Cinema.** Same as Comparative Literature 473. Study of major French directors within the context of French and international cinema. Comparison with selected non-French directors. Relationships of films and other literary forms. 1 unit.
485. **Seminar in Proust, I.** Prerequisite: French 342 or consent of instructor. 1/2 unit. Offered in 1972-1973 and in alternate years.
486. **Seminar in Proust, II.** Prerequisite: French 342 or consent of instructor. 1/2 unit. Offered in 1972-1973 and in alternate years.
491. **Individual Topics.** 1/4 to 1 unit.
499. **Thesis Research.** 0 to 4 units.

GENERAL ENGINEERING

Head of Department: Professor J. S. DOBROVOLNY

Department Office: 117 Transportation Building

101. **Engineering Graphical Communication.** Conveying ideas by means of freehand sketches; orthographic projection including auxiliary views; isometric and oblique projections; dimensioning; geometric and positional tolerancing; specification of materials;

use of national standards; charts and diagrams. Credit is not given for General Engineering 101 in addition to General Engineering 103 or 105. Prerequisite: Plane geometry. 3 hours.

103. **Engineering Graphics, I.** An integrated course in engineering graphics for all students in the College of Engineering. Freehand sketching; theory of orthographic projection and the analysis and synthesis of theoretical and practical problems involving the size, shape, and/or relative positions of common geometrical magnitudes such as points, lines, planes, and other surfaces and solids; theory of pictorial projections; basic dimensioning; basic charts and diagrams. Credit is not given for General Engineering 103 in addition to General Engineering 101 or 105. 3 hours.
104. **Engineering Graphics, II.** Continuation of General Engineering 103, extended to the dimensioning for interchangeable assembly including geometric and positional tolerancing; specification of materials and processes; solution of problems requiring individual creativity. Prerequisite: General Engineering 103 or equivalent. 3 hours.
105. **Elements of Drawing.** Lettering, orthographic projection, dimensioning, development, and process and other symbols. For students in aircraft maintenance. Credit is not given for General Engineering 105 in addition to General Engineering 101 or 103. Prerequisite: Plane geometry. 3 hours.
107. **Geometry for Architects.** Instrumentation; lettering; projection; intersections; conventions; shades and shadows; and perspective drawing for students in architecture. Prerequisite: Plane geometry. 2 hours.
108. **Geometry for Architects.** Continuation of General Engineering 107. Shades and shadows; oblique, isometric, and perspective drawing for students in architecture. Prerequisite: General Engineering 107. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
212. **Graphical Calculations.** Use of various types of slide rules, with special attention to the log-log scales; rectification of curves from laboratory data to devise empirical equations using various types of coordinate paper; design and construction of nomographs or alignment charts. For students in engineering; accepted as an approved elective in all engineering curricula. Prerequisite: General Engineering 103 or equivalent; Mathematics 120. 1 hour.
220. **History of Engineering.** Study of the important elements in the growth of the art and science of engineering from ancient times to the present; lives of some of the men who have been leaders; effect of engineering on the social conditions of the various periods. Prerequisite: Junior standing or consent of instructor. 3 hours.
221. **Introduction to General Engineering Design.** Fundamental concepts involved in design problems, in production methods in construction. Practice in cost analysis, planning, consideration of materials, and engineering computations involved in analysis of engineering design problems. Prerequisite: General Engineering 103 and 104; credit or registration in Theoretical and Applied Mechanics 150. 3 hours.
222. **Analysis of Dynamic Systems.** An introduction to the operational techniques used in describing the behavior of dynamic systems; elements of modeling; equilibrium and linearization; Laplace transformation techniques; system response via the transfer function; block diagrams and computer simulation; matrix operations; system response via state variables; stability. Prerequisite: Mathematics 345; registration in Computer Science 101. 3 hours.
230. **Engineering Aspects of Contemporary Society.** A survey of twentieth-century engineering capabilities in cooperation with other disciplines to selected major problems of society. Prerequisite: Senior standing or consent of instructor. 3 hours.
231. **Engineering Analysis, I.** Application of statics and dynamics to the analysis of fundamental problems of simple structures and mechanisms. Prerequisite: General Engineering 221; Theoretical and Applied Mechanics 211. 3 hours.
232. **Engineering Analysis, II.** A study of stress conditions in various engineering materials and configurations as applied to the development of design criteria. Prerequisite: General Engineering 231; Theoretical and Applied Mechanics 221. 4 hours.

- 236. Hydraulic and Pneumatic Controls.** Fundamental principles of automatic control with particular emphasis on process control. Modes of control covered include on-off, proportional, proportional with reset, and proportional with reset and derivative control. Hydraulic and pneumatic controller circuits and final control elements are studied. Prerequisite: Electrical Engineering 220 and Mathematics 140, 141, or 145; registration in curriculum for Bachelor of Science degree in the teaching of engineering technology. 3 hours.
- 241. Component Design.** Application of principles and methods of analysis to design of basic engineering components utilizing the common engineering materials. Prerequisite: General Engineering 232; Theoretical and Applied Mechanics 224. 4 hours.
- 242. Project Design.** Design of various engineering projects emphasizing the synthesis of the subject matter covered in previous courses in basic sciences, engineering sciences, analysis, engineering economics, and component design. Prerequisite: General Engineering 241 and 288. 3 hours.
- 281. Engineering Influence on Business Decisions.** A study of the branches, tools, philosophy, and goals of the engineering profession, leading into an analysis of the growing interdependence between engineering functions such as product design, equipment development and quality control, and industrial administration, accounting, marketing, finance, personnel administration, and purchasing. Prerequisite: For non-engineering students, junior standing. 3 hours.
- 282. Introduction to Patent Law.** A survey of the U.S. Patent System, including a brief history; requirements of patentability; patent procedure; infringement and remedies; copyright and trademark laws; unfair competition. Prerequisite: Senior standing. 1 hour.
- 288. Economic Analysis for Engineering Decision Making.** An introduction to economic and operational analysis in the engineering decision making process. Mathematics of finance, mathematical programming, application of probability to decision making and queueing. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.
- 290. Legal Aspects of Engineering Contracts and Specifications.** Same as Civil Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; business and technical clauses of specifications. Credit is not given for both General Engineering 290 and 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
- 291. General Engineering Seminar.** A series of lectures and discussions by department faculty and visiting professional engineers on ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. Prerequisite: Senior standing in general engineering. 0 credit.
- 292. Engineering Law.** The legal basis of the social relationships between individuals and groups of individuals; the influence of the historical development of law on modern legal codes and their interpretation; legal aspects of personal rights and liabilities with relation to torts, equity, the problems of property rights, water rights, real property, special assessments, and patent rights. Credit is not given for General Engineering 292 in addition to Civil Engineering 290 or General Engineering 290. Prerequisite: Senior standing in engineering or architecture, or consent of instructor. 3 hours.
- 293. Special Problems.** Individual investigations of studies of any phase of general engineering selected by the student and approved by the department. Prerequisite: Junior standing; consent of instructor. 1 to 4 hours.
- 304. Professional Expression.** Reading and critical study of significant authors from Plato to W. H. Whyte, selected for their contributions to intellectual breadth, imagination, and perfection of style. Original projects allow coordination with seminar and other content courses, and permit the mature student to gain any needed knowledge of reports, administrative correspondence, and articles for publication. Prerequisite: Advanced or graduate standing and consent of instructor. 3 or 4 hours, or 1 unit.
- 313. Advanced Methods in Engineering Graphical Computations.** Application of determi-

- nants in the theory and construction of engineering nomograms; curve fitting and formulations of empirical formulae; methods and applications of graphical calculus. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 2 to 4 hours, or 1/2 to 1 unit.
330. **Industrial Standardization.** Evolution and history of standardization; local, national, and international standardization; governmental standardization. Special emphasis is placed on standardization procedures for individual industrial establishments. Prerequisite: Junior standing or consent of instructor. 2 hours or 1/2 unit.
334. **Introduction to Reliability Engineering.** Same as Industrial Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 333 or Mathematics 361 or equivalent with consent of instructor. 3 hours, or 3/4 or 1 unit.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, Geography, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
360. **Engineering Applications of Meteorological Fundamentals.** The application of the fundamentals of meteorology to engineering problems including the transport and diffusion of particulate matter, aerosols, and gases; precipitation processes and rain-out; behavior of stack effluents, explosion debris, and radioactive materials in the atmosphere. Application to operations scheduling and to site selection. Prerequisite: Senior standing in engineering, chemistry, or physics; Mathematics 140, 141, or 145; Physics 106, 107, and 108; Mechanical Engineering 205 and 206 or 209, or Chemistry 342 and 344, or Physics 360. 4 hours or 1 unit.
393. **Special Problems.** Study of advanced problems related to general engineering and graphics. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or 1/4 to 1 unit.

GEOGRAPHY

Head of Department: Professor J. THOMPSON

Department Office: 220 Davenport Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in geography in addition to Geography 103. At least fifteen of the twenty hours must be in courses carrying advanced credit. Individual programs are arranged for major students with the following special interests: liberal education, business, cartography, government, teaching, or graduate study. These programs include departmental courses, minor fields, and recommended electives.

Minors: Twenty hours in one or two College of Liberal Arts and Sciences departments or in interdepartmental programs approved by the college. Minor programs in departments outside the College of Liberal Arts and Sciences may be arranged in consultation with the departmental adviser and with the approval of the dean of the college. At least eight hours of the twenty minor hours must be taken in each if the student elects to minor in two different departments.

Departmental Distinction: Students eligible for graduation with Honors in Liberal Arts and Sciences should consult with the departmental adviser concerning graduation with distinction in geography.

102. **Physical Geography, I.** An introduction to the processes responsible for the spatial variation of weather and climate with a survey of world climatic patterns. 4 hours.
103. **Physical Geography, II.** The study of spatial relationships between the basic patterns of vegetation, soil, and landforms of the world. 4 hours.

104. **World Regional Geography.** The geographic structure of the world; natural, human, and cultural regional patterns and their interrelations; man's occupation of the natural environmental regions of the world. 4 hours.
105. **Introductory Economic Geography.** Geographic analysis of the distribution of various kinds of economic activity. An examination of the patterns resulting from man's exploitation of the world's resources. Emphasis is placed on the principles governing the location of mineral, manufacturing, and commercial activities. 4 hours.
185. **Introduction to Social Statistics.** Same as Sociology 185. A first course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours.
195. **Undergraduate Honors Seminar.** Through discussions and research projects, the seminar is designed to provide an in-depth understanding of the field of systematic or regional geography selected for group study. Appropriate geographic methodology is emphasized. Prerequisite: James Scholar standing or other designation as a superior student. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
210. **Geography in World Affairs.** Discussions of the role played by various physical and cultural geographic patterns in past and contemporary world and national affairs. 3 hours.
211. **Agricultural Climatology.** Climatic elements and controls; types of climate; graphic and cartographic representation of climatic data; macroclimates and microclimates in relation to agriculture. 3 hours.
214. **Conservation of Natural Resources.** Elements of the conservation of natural resources (soils, water, biotic, mineral, recreational), with emphasis given to the general principles of conservation as they apply to the United States. 3 hours.
223. **Geography of Anglo-America.** Occupation patterns of the United States and Canada; regions of Anglo-America; United States and Canada in world relations. 3 hours.
241. **Historical Geography of Europe.** The evolution of occupation patterns of Europe from the origin of Mediterranean landscapes through the Industrial Revolution. 3 hours.
272. **Introductory Field Geography.** The application of fundamental geographical field techniques to field mapping. Designed to develop field mapping skills, to permit practical application of geographical principles, and to provide a basic understanding of field procedures introductory to advanced field geography for the student who later seeks an advanced degree. 5 to 8 hours.
295. **Independent Study in Geography.** Supervised independent study of special topics or regions. Required for students graduating with departmental distinction. Prerequisite: At least one formal course in the topic or region of interest; consent of instructor. 2 to 4 hours. May be repeated once for credit.
297. **Scope and Purpose of Geography.** Seminar on the nature of geography; a brief history of the discipline, and an examination of its methodology, content and emerging trends. Strongly recommended for students planning graduate work in geography. 2 hours.
303. **Advanced Physical Geography.** A systematic analysis of the basic elements of physical geography and their interaction through time and surface expression, including the modifying effects of man. The course is complementary to Geology 301. Prerequisite: Geography 101 or 103, or consent of instructor. 4 hours or 1 unit.
305. **Zoogeography.** An introduction to the principles of zoogeography; the central theme explains present distribution of animals, chiefly mammals. Prerequisite: Geography 102 and 103, Geology 102, Zoology 104, or consent of instructor. 3 hours or 1 unit.
306. **Maps and Cartobibliographical Aids.** An examination of the problems involved in the acquisitions, care, and library use of maps. Classes become familiar with the major cartobibliographical and related aids. 2 hours or 1/2 unit.
313. **Climate of the Continents.** A regional treatment of the climates of the world by conti-

nents. Prerequisite: Geography 102 or consent of instructor. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years.

314. **Regional Problems in Conservation of Natural Resource..** The distribution, use, and interrelationships of the resources in the various resource management regions of the United States, the conservation techniques applied to them, and the problems of public policy in their effective management. 3 hours or 3/4 unit.
323. **Geography of the North American Midwest.** The core of the North American continent; detailed analysis of the functions and patterns of the Midlands and their external relations. 3 hours or 3/4 unit.
325. **Historical Geography of North America.** Changing patterns of spatial organization in the United States and Canada, circa 1400 A.D. to 1870. Focus on changing landscape patterns through time, perception of relict landscapes in the present day, and contemporary preservation of historic areas. 3 hours or 1 unit.
331. **Geography of Caribbean America.** A survey of the physical elements and occupance sequences that distinguish the geographic regions of Mexico, Central America, Panama, and the West Indies. 3 hours or 3/4 unit.
332. **Geography of South America.** A regional geography of South America with emphasis on the southern hemisphere of that continent. 3 hours or 3/4 unit.
342. **Geography of Europe.** Influence of the climate, surface features, and natural resources on the distribution of the people, their industries and routes of trade; new boundaries and present economic problems in their geographic setting. 3 hours or 3/4 unit.
348. **Air Pollution Seminar.** An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
351. **Geography of Asia.** A regional geography of Asia with concentration on the Monsoon Realm of southern and eastern Asia. 3 hours or 3/4 unit.
353. **Geography of the U.S.S.R.** Physical and cultural regionalism; a survey of natural resources and patterns of human occupance including industry, agriculture, and transportation. 3 hours or 3/4 unit.
355. **Geography of Central and South Africa.** A regional geography of Africa south of the Sahara. 3 hours or 3/4 unit.
357. **Geography of the Middle East and North Africa.** A regional geography of an area with limits largely defined in terms of Arab and Moslem influence or closely related cultural and historical circumstances. The course is oriented around the strategic centrality of the core of the territory as the crossroads of Europe, Asia, and Africa. 3 hours or 3/4 unit.
361. **Geography of Agricultural Land Utilization.** A geographic consideration of the nature of agricultural land utilization from the world, continental, and regional viewpoints. Special emphasis on the geographical implications of various types of agricultural land use and upon the interrelationships between areas of different types of land utilization. 3 hours or 3/4 unit.
362. **Geography of Manufacturing.** An analysis of the factors bringing about geographical concentration of industry. Each of the major manufacturing regions of the world is described and analyzed in terms of the geographic conditions which have influenced its location and products. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years.
363. **Geography of Minerals.** Geographic aspects of the mineral industries. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years.
365. **Geography of Transportation.** A consideration of the agents of transportation (land, water, air), the routes of transportation, transportation terminal complexes, and the basic commodity exchange services of transportation within the framework of their regional and interregional relationships. 3 hours or 3/4 unit.
366. **Location of Industry and Other Economic Activities: Theory and Practice.** Locational theory applied to the relationship between geographic facts of relief, climate, resources,

population, and transportation and the industrial location process; case studies in the effects of transportation networks and rate, sources of materials, labor supply, location of markets, etc., on the selection and evaluation of industrial sites. Study of factors affecting location of stores and other commercial activities. 3 hours or 3/4 unit.

369. **Introduction to Human Ecology.** Same as Anthropology, Health Education, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.
370. **Quantitative Methods in Geography.** Geographical applications of statistical and mathematical research techniques. Prerequisite: Geography 185, one year of college mathematics, one course in statistics, or equivalent. 3 hours or 3/4 unit.
371. **Introduction to Research, I.** Introductory training in bibliographical and cartographic techniques as source materials of geographic research. Prerequisite: Geography major. 3 hours or 3/4 unit.
373. **Map Compilation and Construction.** Laboratory instruction and practice in the basic techniques of map making followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed). Included are the selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. 4 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Health Education, Physiology, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Geography 369. 4 hours or 1 unit.
378. **Descriptive Interpretation of Remote Sensors.** Descriptive interpretation of remote-sensing images with emphasis on interpretation of aerial photographs. Applications of aerial photography and photographic interpretation to the solution of problems in the major field of the individual student. Two half-day field trips on Saturday. 4 hours or 1 unit.
381. **Russian Culture History and Ethnology.** Same as Anthropology 381. A historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or 1/2 or 1 unit.
382. **Siberian Culture History and Ethnology.** Same as Anthropology 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or 1/2 or 1 unit.
383. **Urban Geography.** The distribution, functions, and internal structures of cities; a geographic analysis and classification of urban centers and their tributary areas. 3 hours or 3/4 unit.
384. **Interaction in the Geographical Environment.** Human interaction in social and geographic spaces. Introduction to interaction models in social geography and to mechanisms of information flow that underlie the human spatial interaction processes. Detailed consideration is given to the social and spatial dimensions of individual action spaces and to theories of migration. 3 hours or 1 unit.
385. **Perception of the Geographical Environment.** Introduction to the study of environmental perception, especially the parameters of human spatial awareness. Focus is on proxemic behavior and human space needs, space searching and locational decisions, and symbolic value in landscape and place preferences. 3 hours or 1 unit.
386. **Political Geography.** World patterns of nations in relation to their natural environmental backgrounds: European nations; Africa, the exploited continent; national structures in Asia; western hemisphere nations. 3 hours or 3/4 unit.

412. **Analytical Climatology.** A detailed consideration of the character and causes of the climates of certain selected areas; the application of various criteria as bases for climatic differentiation. Prerequisite: Geography 111; Geography 313 or equivalent; consent of instructor. 1 unit.
421. **Regional Concepts in Geography.** Theories of regionalism, nature of the geographic region, the unique position of regionalism in a total geographic philosophy; regionalism in applied geography. Prerequisite: Nine hours of regional geography. 1/2 unit.
429. **The Evolution of Agricultural Economics.** Same as Agronomy and Anthropology 429. The problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and from the point of view of agronomy and plant genetics. The regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
461. **Fundamentals of Bioclimatology.** Same as Physiology 461. The effects of physical factors (such as barometric pressure, temperature, humidity, radiation, and air movement) on physiological processes in mammals; and the application of meteorological, climatological, and geographical techniques in physiological studies. Prerequisite: Consent of instructor. 3/4 unit.
462. **Experimental Bioclimatology.** Same as Physiology 462. Laboratory work and demonstrations on methods of measuring meteorological factors, of clinical thermometry, and of partitional calorimetry; laboratory work on physiological adjustments of man to heat, cold, and high altitude. Prerequisite: Physiology 301, or 401 and 402; credit or registration in Geography 461. 1/2 unit.
463. **Historical Geography.** Objectives and methods of historical geography. 1 unit.
464. **Advanced Human Bioclimatology.** Same as Physiology 464. Topics in human bioclimatology and medical geography, such as climatic determinism, meteorotropism, the weather elements as stresses, and acclimatization. Prerequisite: Geography 461. 1/2 unit.
471. **Advanced Research Concepts.** Development of research strategies for geographic studies. An examination of contemporary geographic theory from the standpoint of both application and policy-oriented research. Prerequisite: Geography 371. 1/2 unit.
473. **Problems in Cartography.** Subjects for map presentation are selected in the student's field of specialization or area of interest. Data are collected and maps compiled and carried to completion in final drafted form suitable for publication. Prerequisite: Geography 373 or consent of instructor. 1 unit.
477. **Area Analysis.** Individual analysis of areas in the vicinity of Urbana. 1 unit.
478. **Advanced Field Geography.** A graduate course in the theory and application of geographical field techniques to the analysis of areas, culminating in individual reports on assigned problems in the field course area. 1 1/4 to 2 units. Offered in the summer session only.
495. **Advanced Studies in Geography.** Directed and supervised detailed investigation of selected problems or regions. Designed to develop ability to conduct independent investigation. 1/2 to 2 units. Work may be taken in the following sections:
- (a) Physical Geography, Africa, Agricultural Origins. ALEXANDER.
 - (c) Asia, Remote Sensing, Resource Management, Transportation. BOOTH.
 - (d) Urban Geography, U.S.S.R. FELLMANN.
 - (e) Middle East, Advanced Cartography, Field Methods. FOSTER.
 - (f) Anglo America, Political Geography, Regionalism. GARLAND.
 - (g) Economic Geography, Industrial Location, Europe. ROEPKE.
 - (h) Europe, Marketing Geography. RUSSELL.
 - (i) Human Ecology, U.S.S.R. SHIMKIN.
 - (j) Cultural Geography, Latin America. THOMPSON.
 - (l) Paleocology, Soils, Zoogeography. JOHNSON.
 - (m) Historical, Cultural, Population Geography. JAKLE.
 - (o) Social Geography, Migration, Quantitative Methods. ROSEMAN.

497. Development of Geographic Thought. A consideration of the various philosophies of geography and of the men who reflect them. 1/2 unit.

499. Thesis Research. 0 to 4 units.

GEOLOGY

Head of Department: Professor F. A. DONATH

Department Office: 249 Natural History Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Not less than twenty hours in geology, excluding all 100-level geology courses except Geology 115. Included must be Geology 332 or Geology 233, Geology 320 and 321 or Geology 222, Geology 215, and at least one additional 300-level course in geology.

In addition, the student must complete either Chemistry 101 or 107, Physics 101 or 106, and Mathematics 120.

Minors: Twenty hours chosen from one or two of the following subjects: anthropology, astronomy, biology, botany, chemistry, civil engineering, economics, geography, mathematics, mining engineering, physics, and zoology, after consultation with the Department of Geology. At least eight hours must be taken in each subject if two are chosen.

Departmental Distinction: Students who maintain a minimum grade-point average of 4.5 in all geology courses and 4.0 in all other science and mathematics courses, and who complete an acceptable bachelor's thesis based on undergraduate research are recommended for graduation with departmental distinction.

Note: Students should also consider the curriculum in geology which is described in the Undergraduate Study catalog under Specialized Programs, College of Liberal Arts and Sciences. At least one year of graduate work is almost essential for further training for all professional work in geology.

Oceanography: Students interested in oceanography should consult the Department of Geology about academic programs.

- 101. Physical Geology.** Materials, structures, surface features of the earth, and processes which have produced them. Lectures, quiz, and laboratory. One-half day field trip required; estimated cost, \$2.00. 4 hours.
- 102. Historical Geology.** Evolution of the earth and its life. Lectures and laboratory. One-day field trip required; estimated cost, \$5.50. Prerequisite: Geology 101, 105, 142, or 250. 4 hours.
- 105. Agricultural Geology.** Principles of physical geology with emphasis on those useful to students of agriculture. One-half day field trip; estimated cost, \$2.00. For agricultural students only. Prerequisite: One semester of chemistry. 4 hours.
- 111. Honors: Physical Geology.** A two-day field trip is required. Prerequisite: Registration in the honors section of Geology 101, James Scholar, or consent of instructor. 1 hour.
- 112. Honors: Historical Geology.** A two-day field trip is required. Prerequisite: Registration in the honors laboratory of Geology 102, James Scholar, or consent of instructor. 1 hour.
- 115. Regional Field Study.** Field observations in a region of diverse geology. One- to two-week field trip. Credit is given only on completion of a satisfactory written report. Prerequisite: Geology 101, 105, 142, or 250. 2 hours.
- 142. Earth Evolution and Chemical Environments.** Same as Liberal Arts and Sciences 142. A physical science course for non-science majors, presenting a general discussion of the origin and evolution of the earth, its continents and ocean basins, and basic chemical aspects of the earth's ecologic systems, including water and air pollution, radiation chemistry, and the use of pesticides in nature. 4 hours.

143. **Environmental Physical Science.** Same as Liberal Arts and Sciences 143. A physical science course for non-science majors with emphasis on earth processes and resources relevant to modern society. The course attempts to place in perspective the physical limitations imposed by earth, by discussing the physical nature of the environment and the basic principles that apply within it. Specific topics include matter and energy availability, pollutant levels, and conditions for a stable environment. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
215. **Field Geology.** Field course to be conducted from a suitable geologic locality. Introduction to field techniques, geologic mapping, and field training in stratigraphy, structure, and geomorphology. Prerequisite: Geology 102; consent of instructor. 8 hours. Offered in the summer session only.
222. **Paleontology and Stratigraphy.** A systematic study of fossils, their classification and morphology, and general principles of stratigraphy. Students may not receive credit for Geology 222 and Geology 320. Prerequisite: Geology 102. 4 hours.
233. **Minerals and Rocks.** A systematic study of minerals and rocks with emphasis on their nature as crystalline materials, their occurrence and geologic relationships, and their economic significance. Students may not receive credit for Geology 233 and Geology 331. Prerequisite: Chemistry 101, Geology 102, or consent of instructor. 4 hours.
250. **Geology for Engineers.** Physical geology with an emphasis on those aspects of the natural environment which are of importance to the engineer. Prerequisite: Theoretical and Applied Mechanics 150 or 152; sophomore standing in the College of Engineering. 3 hours.
290. **Research and Thesis.** Individual work under supervision of members of the staff in their respective fields. The research may lead to a bachelor's thesis, which is one requirement for graduation with departmental distinction. Each student who desires to register in this course must present to the head of the department a written statement from the instructor under whom he is to work. Credit to be arranged.
301. **Geomorphology.** The study of the history, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion or by a combination of these, acting upon the major kinds of geologic materials and structures. Lectures, laboratory, and field trips. Prerequisite: Geology 102. 4 hours or 1 unit. JOHNSON.
303. **History of Geology.** The development of the fundamental concepts of the geological sciences from classical to modern times. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit. CAROZZI.
307. **Advanced Dynamic Geology.** A study of geologic processes and their effects. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit.
309. **Sedimentology.** An introduction to principles of sediment erosion, transport, and deposition. Origin of sediment texture, sedimentary structures, sedimentary sequences, sediment mineralogy and diagenesis. Sediment deposition in fluvial, deltaic, deep water, tidal flat, continental shelf, beach and barrier island environments. Prerequisite: Geology 102 or consent of instructor. 2 hours or 1/2 unit.
310. **Field and Laboratory Procedures in Sedimentology.** An introduction to the field and laboratory study of Holocene sediments and sedimentary rocks, with emphasis on field sampling, sieve-size analysis, peel-making of unconsolidated sediments and sedimentary rocks, x-ray radiography, disaggregation of sediments, heavy mineral analysis, mineral identification by staining, pH-Eh determinations, and thin-section preparation. Required field work. This course must be taken concurrently with Geology 309. Prerequisite: Geology 102. 1 hour or 1/4 unit. KLEIN.
311. **Structural Geology.** Rock deformation and its results. Lectures, laboratory, and one two-day field trip. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit. WOOD.
315. **Advanced Field Methods.** Mapping a structurally and/or stratigraphically significant area of moderate size and difficulty. Preparation of a report. Prerequisite: Geology 215. 2 to 8 hours, or 1/2 to 2 units. Unit credit to be determined.

320. **Invertebrate Paleontology.** Fossil groups in the biological sequence. Lectures and laboratory. Students may not receive credit for both Geology 320 and 222. Prerequisite: Geology 102. 4 hours or 1 unit. BLAKE, SANDBERG.
321. **Principles of Stratigraphy.** Definition of stratigraphic units, correlation, facies, paleogeography, and historical inference. Techniques of physical stratigraphy. Prerequisite: Geology 102. 4 hours or 1 unit. LANGENHEIM, MANN.
322. **Stratigraphic Paleontology.** Faunal sequences in time and their use in rock correlation. Prerequisite: Geology 320 and 321, or consent of instructor. 4 hours or 1 unit. BLAKE.
325. **Paleobotany.** Same as Botany 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. Prerequisite: Botany 100 or Biology 100 and 101, and Geology 101; or consent of instructor. 5 hours or 1 unit. PHILLIPS.
332. **Mineralogy-Petrology.** An introduction to the structure, chemistry, and stability of the major silicate minerals and their occurrence in rocks. Prerequisite: Geology 102; Chemistry 102 or 108. 4 hours or 1 unit. D. ANDERSON.
335. **Optical Mineralogy.** Study of crystalline matter, especially minerals, by polarized light microscopy and powder x-ray diffractometry. Prerequisite: Geology 332. 4 hours or 1 unit. HENDERSON.
336. **Igneous and Metamorphic Petrography.** Study of the constituents, composition, texture, structures, and classification of igneous and metamorphic rocks. In the laboratory, rocks are studied in hand specimen and thin section. Prerequisite: Geology 335. 4 hours or 1 unit. CHAPMAN.
338. **Introduction to Sedimentary Petrography.** An introduction to the microscopic study of sedimentary rocks in thin section with emphasis on their textural properties as a basis for their classification and environmental interpretation. Prerequisite: Geology 335. 2 hours or 1/2 unit. CAROZZI.
350. **Theoretical Geophysics.** An introduction to the major fields of theoretical geophysics: figure of the earth, thermodynamics of the earth, gravity, seismology, magnetism, and planetary geophysics. Prerequisite: Mathematics through calculus; one year of physics; Geology 311; consent of instructor. 4 hours or 1 unit. HOLDER.
351. **Geophysical Prospecting.** Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or 3/4 or 1 unit. DEWITTE.
357. **Glacial and Pleistocene Geology.** Consideration of glacial flow, erosion, and deposition; stratigraphic analysis of glacial deposits and correlation of Pleistocene glacial successions with non-glacial sediments. Prerequisite: Consent of instructor. 4 hours or 1 unit. JOHNSON.
360. **Chemistry of the Earth.** Study of geochemical processes; origin and distribution of elements and isotopes in rocks, sediments, and natural waters. Prerequisite: Geology 332. 3 hours or 3/4 unit. T. ANDERSON, GRAF.
370. **Oceanography.** Principles of biological, chemical, geological, and physical marine science. Prerequisite: Botany 100 or Zoology 104; Chemistry 101, Geology 101, and Physics 101; or consent of instructor. 4 hours or 1 unit. HAY.
415. **Regional Field Geology.** Field study of critical localities within a geologic province during a period of two or three weeks; discussion of observations and preparation of reports in which the concepts and principles mastered in graduate study are applied to regional geologic synthesis. Prerequisite: Consent of instructor. 1 unit.
420. **Paleoecology.** Interpretation of life habit of fossil organisms from skeletal morphology and associated depositional features; reconstruction of marine ecosystem relationships from the study of assemblages of fossils. Prerequisite: Geology 320 or equivalent. 1 unit.
421. **Advanced Invertebrate Paleontology.** Intensive study of a selected invertebrate group. Prerequisite: Geology or Zoology 320. 1 unit. May be repeated for credit.
422. **Stratigraphic Geology: Paleozoic.** The concept of the Paleozoic Era and its periods,

- series, stages, and zones; evaluation of the type sequences and the succession of faunas; problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit. LANGENHEIM.
423. **Stratigraphic Geology: Mesozoic.** The concept of the Mesozoic Era and its periods, series, stages, and zones; evaluation of the type sequences and the succession of faunas; problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit. MANN.
424. **Stratigraphic Geology: Cenozoic.** The concept of the Cenozoic Era and its periods, series, stages, and zones; evaluation of the type sequences and the succession of faunas; problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit.
425. **Micropaleontology: Benthonic Foraminifera.** Classification, biology, and distribution in time and space of benthonic foraminifera: emphasis on ecology and evolution. Prerequisite: Geology 320 or Zoology 320, or Zoology 318. 1 unit. HAY.
426. **Micropaleontology: Ostracoda.** Morphology, classification, ontogeny, and phylogeny of fossil and living Ostracoda; study of stratigraphic, paleoecologic, and ecologic distribution, and of soft part morphology. Prerequisite: Geology 320 or Zoology 320. 1 unit. SANDBERG.
427. **Micropaleontology: Conodonts.** Morphology and history of conodonts, chitinozoans, and lesser groups with emphasis on use in biostratigraphy and paleogeography. Prerequisite: Geology 320 or Zoology 320; consent of instructor. 1 unit. COLLINSON.
428. **Micropaleontology: Plankton.** Classification and distribution of major groups of shelled oceanic plankton; foraminifera, radiolaria, coccolithophores, diatoms, and others; emphasis is on biostratigraphic use of these fossils. Prerequisite: Geology 320 or Zoology 320 or Zoology 318; consent of instructor. 1 unit. HAY.
430. **Crystallography.** A consideration of the approaches and techniques required for an understanding of the structures and properties of crystals, especially those of minerals; emphasis is given to the development of pattern theory, space groups, and their applications. Prerequisite: Geology 335 or equivalent; consent of instructor. 1 unit. HENDERSON.
431. **Structural Mineralogy.** Principles of the crystal chemistry and structural classification of minerals, and survey of the current knowledge about the structures and structurally dependent properties and behavior of representative minerals and mineral groups. Prerequisite: Geology 430; consent of instructor. 1 unit. GUVEN, HENDERSON.
432. **Sedimentary Geochemistry.** Equilibrium assemblages among the principal organic and inorganic sedimentary solids and their associated liquids during weathering, deposition, and diagenesis; kinetics and mechanism of phase changes; transport processes during diagenesis. Prerequisite: Geology 360 or equivalent, or consent of instructor; some background in physical chemistry desirable. 1 unit. GRAF.
433. **X-ray Mineralogy.** Introduction to the principles and methods of x-ray analysis of polycrystalline mineral phases. Prerequisite: Consent of instructor. 1 unit. GUVEN.
434. **Theoretical Petrology.** Use of thermodynamic and kinetic arguments in the solution of basic petrological problems. Prerequisite: Consent of instructor. 1 unit. D. ANDERSON.
435. **Igneous Petrology.** The origin and history of igneous rocks. Application of chemistry and physics to igneous petrology. In the laboratory, a study is made of selected rock suites, and special methods of petrographical investigation are covered. 1 unit. CHAPMAN.
436. **Metamorphic Petrology.** Problems in metamorphism and advanced studies of metamorphic rocks. In the laboratory, selected rock suites are studied and special methods of investigation are covered. 1 unit. D. ANDERSON.
437. **Sedimentary Processes.** Application of fluid mechanics to quantitative analysis of erosion, transport, and deposition by open channel flow, waves, tidal currents, longshore currents, turbidity currents, wind and ice; quantitative determination of origin of physical sedimentary parameters and sedimentary mineralogy; processes of weathering and diagenesis. Prerequisite: Geology 335 or equivalent, or consent of instructor. 1 unit. KLEIN.

438. **Sedimentary Petrography.** Microscopic study of sedimentary rocks in thin section with emphasis on textures and structures as a basis for their detailed classification and genetic interpretation. Prerequisite: Geology 335 and 437. 1 unit. CAROZZI.
440. **Mineragraphy.** Microscopic study of ore minerals, including methods of identification, textures, structures, and paragenesis. 1 unit. HAGNER.
443. **Mineral Deposits.** Principles of mineral deposition and genesis of mineral deposits. Prerequisite: Geology 311. 1 unit. HAGNER.
444. **Mineral Deposits.** Structural control of mineral deposition and a study of the principal types of mineral deposits. Laboratory study of structures and of types of deposits. Prerequisite: Geology 443. 1 unit. HAGNER.
450. **Principles of Engineering Geology.** Study of the effects that lithology, weathering, joints, faults, and ground water have upon engineering projects. The origin, exploration, description, analysis, and significance of geologic factors are studied and illustrated with case histories. A three-day field trip is an integral part of the course. Prerequisite: Geology 250 or equivalent, or consent of instructor. 1 unit. DEERE.
451. **Practice of Engineering Geology.** A study of current and past case histories that illustrate the applications of the principles of engineering geology. These studies include those where lithology, weathering, joints, faults, and ground water have influenced the exploration, design, construction, and maintenance phases of engineering projects. A three- or four-day field trip to visit engineering construction projects is an integral part of the course. Prerequisite: Geology 450 and Civil Engineering 383, or consent of instructor. 1 unit. DEERE.
455. **Hydrogeology.** The geology of the occurrence, storage, movement, and quality of water in the rocks of the Earth's crust. Prerequisite: Consent of instructor. 1 unit. DOMENICO.
456. **Advanced Hydrogeology.** Geologic aspects of regional flow and ground water development with emphasis on geologic description and modeling of ground water systems. Prerequisite: Geology 455. 1 unit. DOMENICO.
461. **Mineralogy of Clays.** Same as Ceramic Engineering 461. The composition of various types of clays; the structure and properties of the clay minerals; the origin and mode of occurrence of the clay minerals and clay materials. Prerequisite: Geology 336 or equivalent; consent of instructor. 1 unit. GUVEN.
462. **Mineralogy of Clays.** Same as Ceramic Engineering 462. The properties of clay materials, their relation to the structure of the clay minerals, methods of determination and control; the utilization of clays in various arts and industries. Prerequisite: Geology 461. 1 unit.
471. **Submarine Geology.** General geology of the ocean basins and continental margins, with emphasis on the geological interpretation of marine geophysical investigations. Prerequisite: One year of physics or consent of instructor. 1 unit.
477. **Recent Sedimentary Environments.** A review of sedimentary processes, physical sedimentary parameters, and sedimentary mineralogy in fluvial, lake, dune, beach, barrier island, bar, deltaic, tidal flat, lagoonal, bay, marsh, continental shelf, continental margin, submarine fan, submarine canyon, and deep ocean floor environments. Sedimentological aspects of land usage, conservation and preservation of man's environment. Prerequisite: Geology 437 or consent of instructor. 1 unit. KLEIN.
479. **Statistical Geology.** Analysis of the geologic assumptions necessary to fulfill mathematical requirements in numerical analysis of geologic problems. Prerequisite: Mathematics 161 or Agronomy 340; Computer Science 101; consent of instructor. 1 unit. MANN.
488. **Advanced Structural Geology.** Analysis of geologic deformation based upon the principles of mechanics and utilizing research data from laboratory and field investigations; methods in structural analysis. Prerequisite: Geology 311 or consent of instructor. 1 unit. DONATH.
489. **Geotectonics.** Nature and distribution of major earth structures and geological and geophysical evidence bearing on their origin. Prerequisite: Geology 311 or consent of instructor. 1 unit. WOOD

493. **Advanced Studies in Geology.** 1/2 to 2 units. Work may be taken in the following fields:
- (a) Clay Mineralogy. GUVEN.
 - (b) Engineering Geology. DEERE.
 - (c) Geomorphology and Glacial Geology. FRYE, JOHNSON.
 - (d) Geotectonics. CAROZZI, WOOD.
 - (e) Ground-Water Geology. DOMENICO.
 - (f) Micropaleontology. COLLINSON, HAY, SANDBERG.
 - (g) Mineral Deposits. HAGNER.
 - (h) Mineralogy and Crystallography. GUVEN, HENDERSON.
 - (i) Paleontology. BLAKE, HAY, LANGENHEIM, SANDBERG.
 - (j) Geochemistry. T. F. ANDERSON, GRAF.
 - (k) Geophysics. DONATH, HOLDER, PALTIAUSKAS.
 - (l) Petrography and Petrology. D. E. ANDERSON, CHAPMAN.
 - (m) Sedimentology. CAROZZI, KLEIN, STANLEY.
 - (n) Stratigraphy. LANGENHEIM, MANN.
 - (o) Oceanography. HAY, KLEIN, STANLEY.
 - (p) Submarine Geology. KLEIN, STANLEY.
 - (q) Structural Geology. DONATH, WOOD.
 - (r) Mathematical Geology. MANN, PALTIAUSKAS.
499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

GERMANIC LANGUAGES AND LITERATURES

(Including German, Germanic, and Scandinavian)

Head of Department: Professor H. G. HAILE

Department Office: 3072 Foreign Languages Building

German

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty-four hours in German excluding German 101, 102, 103, 104, 113, and including 302, 303, 320, and one other literature course at the 300 level.

Minors: Twenty hours in not more than two subjects chosen from the following list, with at least eight hours in each subject: education, English (excluding Rhetoric 101, 102, and 200), French, Greek, history, Italian, Latin, library science, linguistics (excluding 301), medieval civilization studies, philosophy, Portuguese, Russian, Scandinavian, and Spanish. The first semester of any foreign language (French 101, Greek 101, Italian 101, Portuguese 101, Russian 101, Spanish 101) may not be counted toward a minor in that language. Special minors in other subjects can be approved by the undergraduate adviser of the Department of Germanic Languages and Literatures.

Year Abroad Program: The Department sponsors a low-cost, two-semester study program in Austria, based at the Padagogische Akademie in Baden, a suburb of Vienna. By participating, students in the College of Liberal Arts and Sciences can earn thirty-two hours of residence credit in upper-level work in language, literature, education, and civilization. Qualified students in other colleges and schools of the University are encouraged to participate and to develop, with the aid of their advisers, individual programs which take advantage of the facilities and opportunities Vienna has to offer. Participating students enroll in German 351 and 352. For further information, students should inquire at the departmental office.

101. **Elementary Course.** Oral practice, reading, and grammar for beginners. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.

102. **Elementary Course.** Continuation of German 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: One semester of college German or equivalent. 4 hours.
103. **Intermediate Course.** Continuation of German 102. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Two semesters of college German or equivalent. 4 hours.
104. **Intermediate Course.** Continuation of German 103. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Three semesters of college German or equivalent. 4 hours.
112. **Elementary Speaking.** Practice in speaking idiomatic German. Prerequisite: One semester of college German or equivalent. 4 hours.
113. **Intermediate Speaking.** Continuation of German 112. Prerequisite: Two semesters of college German or equivalent. 4 hours.
114. **Intermediate Speaking.** Continuation of German 113. Prerequisite: Three semesters of college German or equivalent. 4 hours.
122. **Elementary Reading.** Practice in reading German, with emphasis on expository prose. Prerequisite: One semester of college German or equivalent. 4 hours.
123. **Intermediate Reading.** Continuation of German 122. Prerequisite: Two semesters of college German or equivalent. 4 hours.
124. **Intermediate Reading.** Continuation of German 123. Prerequisite: Three semesters of college German or equivalent. 4 hours.
134. **Introduction to Literature.** Discussion in English of German literature read in the original. With German 135, this course satisfies the graduation requirement in the College. Prerequisite: Three semesters of college German or equivalent. 3 hours.
135. **Introduction to Literature.** Continuation of German 134. With German 134, this course satisfies the graduation requirement in the College. Prerequisite: Four semesters of college German or equivalent. 3 hours.
142. **Introduction to German Studies.** Introduction to the study of the cultural history of the German speaking peoples together with the history of the German language and German literature. Prerequisite: One semester of college German or equivalent. 2 hours.
153. **Practice in Conversation.** Emphasis on learning to converse in German in an everyday manner. Prerequisite: Two semesters of college German or equivalent. 2 hours.
164. **Practice in Writing.** Practice in using simple, idiomatic German in short essays. Stylistic analysis of model texts. Prerequisite: Three semesters of college German or equivalent. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **German Literature Since 1648 in English Translation.** Same as Humanities 210. The important trends in German literature since 1648. Reading of some important prose works. For students with no knowledge of German. 3 hours.
202. **Society in the Novel.** No knowledge of German required. Portrayal of society in German novels from 1648 to the present. Reading and discussion of works by Grimmelshausen, Goethe, Hoffmann, Fontane, Thomas Mann, Hesse, Kafka, Grass. 3 hours.
203. **Goethe in Translation.** Same as Comparative Literature 203. Introduction to the life and works of Wolfgang Goethe. Focus is on his poetic work, but his major contributions to science are also treated as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as Comparative Literature 204. German medieval pre-courtly and courtly literature in translation. Readings in the works of Hartmann, Gottfried, Wolfram, Walther, and others, including the following epics: *Nibelungenlied*, *Gregorius*, *Tristan*, *Parzival*. 3 hours.
208. **German Source Readings from the History of Science.** Reading and discussion of eighteenth- and nineteenth-century contributions to physics, chemistry, and biology which are basic in the respective discipline. Prerequisite: German 104 or four years of high school German. 3 hours.

210. **Masterpieces of German Literature.** Introduction to German literature, its subjects, forms, and ideals. Prerequisite: Two years of college German or equivalent. 3 hours.
211. **Conversation and Writing.** Prerequisite: German 103 and 113, or 104, or equivalent. 3 hours.
212. **Conversation and Writing.** Continuation of German 211. Prerequisite: German 211 or equivalent, or consent of instructor. 3 hours.
250. **The German Novelle of the Nineteenth Century.** Prerequisite: German 210 or equivalent. 3 hours.
251. **The German Novelle of the Twentieth Century.** Prerequisite: German 210 or equivalent. 3 hours.
252. **Nineteenth-Century German Drama.** Selected works of Kleist, Hebbel, Grillparzer, their eighteenth-century roots, and their background in classical drama. Prerequisite: German 210 or equivalent. 3 hours.
253. **Twentieth-Century German Drama.** Modern German drama from Hauptmann to the present. Prerequisite: German 210 or equivalent. 3 hours.
260. **Lyrics and Ballads.** A poetical and metrical survey of German lyric verse from its beginnings to modern times, with a critical analysis of representative poems. Prerequisite: German 210 or equivalent. 3 hours.
270. **Twentieth-Century German Literature.** Introduction to trends of modern civilization as reflected in contemporary German literature. Prerequisite: German 210 or equivalent. 3 hours.
281. **Teachers Course.** An introduction into the problems of the teaching of German and a study of textbooks. Prerequisite: Consent of instructor. 3 hours.
291. **Senior Thesis and Honors Course.** Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing or consent of instructor. 2 to 4 hours.
292. **Senior Thesis and Honors Course.** Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 hours.
301. **German Literature to 1700.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit.
302. **German Literature Since 1700.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit.
303. **Advanced Conversation, Composition, and Syntax.** Intensive study of advanced problems of grammar, syntax, and style. Prerequisite: German 211 and 212, or equivalent. 3 hours or 1/2 unit.
304. **Advanced Conversation.** Practice in free conversation with native speaker. Will not meet during the six-week student teaching period. Prerequisite: German 303 or equivalent. 1 hour or 0 unit.
305. **Modern German Poetry.** A poetical and metrical survey of modern German lyric verse. Prerequisite: German 210 and one other course in German literature, or equivalent, or consent of instructor. 3 hours or 3/4 unit.
306. **Contemporary German Poetry.** A poetical and metrical survey of contemporary German lyric verse. Prerequisite: German 305 or consent of instructor. 3 hours or 3/4 unit.
311. **Goethe.** Introduction to Goethe's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years.
312. **Goethe's Faust.** Intensive study of Goethe's *Faust*, Parts I and II. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years.
320. **History of German Civilization.** A selected topical, historical, and pictorial analysis of Germany's culture and civilization. Prerequisite: German 210 and one other course in German literature, or equivalent. 4 hours or 3/4 unit.

331. **The Age of Lessing.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years.
332. **Schiller.** Introduction to Schiller's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years.
351. **German Abroad, I.** Lectures, seminars, and practical work in language, literature, education, and civilization, in Austria. Prerequisite: German 212 or equivalent; 3.75 overall average; 4.0 in German courses. 0 to 16 hours, or 0 to 2 units.
352. **German Abroad, II.** Lectures, seminars, and practical work in language, literature, education, and civilization, in Austria. Prerequisite: German 351. 0 to 16 hours, or 0 to 2 units.
365. **German Phonology and Morphology.** Introductory survey of the phonological and morphological structure of the German language. Prerequisite: Three years of college German or equivalent. 3 hours or 3/4 unit.
366. **German Syntax.** The structure of the German sentence; historical development; contrast with English. Prerequisite: German 365 or consent of instructor. 3 hours or 3/4 unit.
382. **Language Laboratory Techniques.** Same as French, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level, or equivalent. 2 hours or 1/2 unit.
392. **Topics in German Literature.** Intensive study of individual authors or other restricted topics in German literature. Prerequisite: Two advanced courses in German literature. 4 hours, or 1 to 2 units.
394. **Introduction to Folklore: History, Theory, Methods.** Same as Comparative Literature and Slavic 394, English 387, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading of one modern foreign language is recommended. 4 hours, or 3/4 or 1 unit.
400. **Beginning German for Graduate Students.** Introduction to the reading of German texts in the sciences and the humanities. 4 semester hours. No graduate credit. SCHWALBE.
401. **Readings in German for Graduate Students.** Designed for graduate students preparing for the German reading requirements for the Ph.D. 4 semester hours. No graduate credit. Prerequisite: German 400 or equivalent. SCHWALBE.
411. **Proseminar.** Methods of literary criticism and research. 1 unit. HAILE.
412. **Proseminar.** Methods in German language study. Prerequisite: German 365 or equivalent. 1 unit. ANTONSEN.
415. **Middle High German.** Prerequisite: German 365. 1 unit. GRAY.
416. **Middle High German Literature.** Prerequisite: German 415 or equivalent. 1 unit. GRAY.
420. **History of the German Language.** Prerequisite: German 365. 1 unit. ANTONSEN.
431. **German Literature of the Middle Ages.** German literature from 800 to 1400. 1 unit. MARCHAND.
432. **German Literature from 1400 to 1700.** Renaissance, Reformation, and Baroque in German literature. Lectures and readings. 1 unit. Offered in 1973-1974 and in alternate years. STEGEMEIER.
441. **German Romanticism.** 1 unit. Offered in 1973-1974 and in alternate years.
442. **Nineteenth-Century German Realism.** Prerequisite: German 301 and 302, or equivalent. 1 unit. Offered in 1973-1974 and in alternate years.
445. **Old High German.** Grammar and interpretation of the oldest literary documents. Prerequisite: German 365. 1 unit. ANTONSEN, RAUCH.

447. **Old Saxon.** Synchronic-diachronic treatment of the language of the *Heliand* and *Genesis*; the position of Old Saxon in the Germanic languages with particular reference to Old High German and Old English. Prerequisite: German 445 or English 401. 1 unit. RAUCH.
451. **Naturalism, Symbolism, Expressionism.** German literature from the 1880's to the 1920's. 1 unit.
452. **German Literature from the Twenties to the Present.** Prerequisite: German 301 and 302, or equivalent. 1 unit.
460. **Seminar in Older German Literature.** Prerequisite: German 411 and 495. 1 unit.
461. **Seminar in Modern German Literature.** Same as Comparative Literature 482. Prerequisite: German 411 and 495. 1 unit.
463. **College Teaching of Foreign Languages.** Same as French, Russian, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, literary appreciation; the use of technology; recent experimentation. 1 unit.
480. **Teaching German in College.** An introduction to the problems of teaching German in college. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, language as an aspect of culture and societal relations. Prerequisite: German 463 or consent of instructor.
493. **Research in Special Topics.** 1/4 to 2 units. May be repeated for a maximum of 2 units.
495. **Bibliography and Methods of Literary History.** To be taken concurrently with German 411. 1/2 unit. MARCHAND.
499. **Thesis Research.** 0 to 4 units. ANTONSEN, FREY, HAILE, LORBE, MARCHAND, MITCHELL, KNUST, RAUCH, STEGEMEIER.

Germanic

367. **Introduction to German Linguistics.** A comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. Some knowledge of German is desirable. 2 hours or 1/2 unit.
426. **Gothic.** An introduction to Germanic (comparative) linguistics. Prerequisite: Germanic 367 or consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years.
462. **Seminar in Germanic Philology and Linguistics.** Problems in diachronic and descriptive Germanic linguistics. Prerequisite: Consent of instructor. 1 to 2 units. ANTONSEN, RAUCH.
465. **Comparative Germanic Phonology and Morphology.** The reconstruction of the phonological and morphological systems of Proto-Germanic and their development into the Germanic languages and dialects. Prerequisite: Germanic 426 or consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years. ANTONSEN, RAUCH.
467. **Runology.** A detailed analysis of inscriptions in the "older" Germanic futhark, the Anglo-Frisian futhorc, and the Scandinavian "younger" futharks; their relationships and the correlation between phonological and orthographic developments. Prerequisite: Germanic 465 or consent of instructor. 1 unit. ANTONSEN.

Scandinavian

101. **Elementary Scandinavian, I.** The first of four semesters leading to a reading knowledge

of Danish, Norwegian, and Swedish, and to an oral command of one of these languages. Linguistic structure, reading, and oral practice. 4 hours.

102. **Elementary Scandinavian, II.** Continuation of Scandinavian 101. Structural differences between Danish or Swedish and Norwegian. Oral practice and reading of simple texts. Prerequisite: Scandinavian 101. 4 hours.
103. **Intermediate Scandinavian, I.** Readings in Danish and Norwegian or Swedish literature. Structure of Swedish or Danish and Norwegian, with stress on the differences between Swedish and Danish. Prerequisite: Scandinavian 102 or equivalent. 4 hours.
104. **Intermediate Scandinavian, II.** Continuation of Scandinavian 103. Readings in classical and modern Danish, Norwegian, and Swedish texts. Prerequisite: Scandinavian 103. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
216. **Conversation and Writing.** Oral practice and composition in one of the Scandinavian languages. Prerequisite: Scandinavian 104. 2 hours.
266. **Twentieth-Century Scandinavian Literature.** Readings and discussion of contemporary Scandinavian poetry, short stories, and plays. Prerequisite: Scandinavian 216. 3 hours.
297. **Senior Thesis and Honors Course.** Prerequisite: Senior standing; consent of instructor. 1 to 2 hours.
361. **Ibsen.** Same as Humanities 361. The dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit. Offered in 1973-1974 and in alternate years.
362. **Strindberg and the Later Scandinavian Dramatists.** Same as Humanities 362. Major dramas and prose works of August Strindberg in translation; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Par Lagerkvist. 3 hours or 1 unit. Offered in 1972-1973 and in alternate years.
405. **Old Norse-Icelandic, I.** Grammar and selected readings. 1 unit. Offered in 1973-1974 and in alternate years. MITCHELL.
406. **Old Norse-Icelandic, II.** Readings. Selections from the Elder Edda and the sagas. Prerequisite: Scandinavian 405. 1 unit. Offered in 1973-1974 and in alternate years. MARCHAND.

Greek

(See Classics)

Greek, Modern

(See Linguistics)

HEALTH AND SAFETY EDUCATION

Head of Department: Professor W. H. CRESWELL, JR.

Department Office: 117 Huff Gymnasium

Health Education

110. **Public Health.** Basic principles of group living including epidemiology studies; scientific methods as applied to environmental health in urban and rural areas; specialized programs. Field trips. Prerequisite: Two hours credit in health education or sophomore standing. 2 hours.
150. **Health and Modern Life.** The dynamics of health in modern life in a rapidly changing world; modern concepts of health, disease, and longevity; current health problems,

issues, and trends; scientific health facts, principles, and theories related to personal, family, and community health; health and longevity progress in the United States. Designed primarily as a professional course for prospective health and safety educators, coaches, physical educators, and recreation workers. Prerequisite: Credit in registration in Zoology 104, or consent of instructor. 3 hours.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Mental Health.** An introduction to the science of mental health and illness including personality development, the genesis and manifestations of mental illness, and the maintenance of mental health. It is taught by a psychiatrist with special emphasis on the preventive and medical aspects of mental health. 2 hours.
206. **Sex Education and Family Life.** Offered to persons who are interested in becoming more critical and obtaining a larger perspective to help their understanding of the problems of sex and family life. Prerequisite: Junior standing or consent of instructor. 2 hours.
216. **Medical Terminology Correlated with Community Health Problems.** A preprofessional course for those entering the occupational therapy curriculum, medical journalism, and paramedical fields. Occupational therapy students given priority the fall semester. Prerequisite: Junior standing; enrollment in the occupational therapy curriculum. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the students. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 credit.
260. **Honors Seminar.** Same as Physical Education for Men, Physical Education for Women, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.
281. **First Aid.** American Red Cross standard course in first aid. 2 hours.
282. **Organization of School Health Programs.** Developing school health programs, including health service, healthful school living, and health instruction based on the health needs and problems of school children. 3 hours.
283. **Man and His Diseases.** Ecologic, including cultural, factors affecting disease in man; changing concepts of disease; epidemiology of communicable and noncommunicable diseases; disease prevention and control. Designed primarily for prospective health teachers in the high schools and colleges and public health educators. Prerequisite: Health Education 110 and 150; Physiology 103. 2 hours.
285. **Sex Education for Teachers.** Theory and practice of family life and sex education; basic issues, philosophy, and guiding principles; needs and objectives; scope and sequence; methods and materials; basic content and concepts; unit and lesson preparation; curriculum; construction; evaluation procedures; Illinois law and family life and sex education programs. Prerequisite: Advanced standing. 2 hours.
288. **Principles of Health Education.** History, scope, needs, and principles underlying the school health program. Prerequisite: Health Education 282. 3 hours.
289. **Health Education Field Work.** Supervised field experiences in official, voluntary, and professional health agencies. Designed to give students in community health education work experience in actual field situations. During the junior or senior year, students work for one semester in University-approved health agencies for a minimum of sixty hours of field work. Prerequisite: Junior standing in community health education. 2 hours.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of

the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.

374. **Problems in Human Ecology.** Same as Anthropology, Geography, Physiology, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Health Education 369. 4 hours or 1 unit.
390. **Public Health Education.** Theory and practice of community health education; adult health education through media such as radio, television, films, slides, posters, pamphlets, and newspapers; projects in preparing and using public health education materials; evaluation of research in public health education. Prerequisite: Senior or graduate standing in health education or consent of instructor. 2 hours or 1/2 unit.
391. **Health Data Analysis.** An introduction to public health statistics including collection and classification of data; rates and other indices; measures of central tendency and dispersion; tests of significance; use of vital statistics in planning, conducting, and evaluating public and school health education programs. Prerequisite: Mathematics 161 or Educational Psychology 390, or equivalent. 2 hours or 1/2 unit.
392. **Health and Safety Education in the Elementary School.** An overview of the school health program designed to acquaint the teacher with modern concepts of health and safety in the elementary school. Consideration is given to the role of the classroom teacher in understanding and meeting the health needs of children. The course focuses on the legal requirements for Illinois schools, major health and safety problems of elementary children, the teacher's role in the school health program, and methods and materials in teaching modern health and safety education. Prerequisite: One year of biological science. 3 hours or 1/2 unit.
393. **Drug Abuse Education.** The psycho-social, pharmacological, and legal aspects of drug use and abuse; school and community responses to drug abuse; and the development of appropriate curricula, materials, and teaching strategies. Prerequisite: Six hours of health education or consent of instructor. 2 hours or 1/2 unit.
400. **Scientific Foundations of Health Education.** Designed to reinforce and extend the student's knowledge of pertinent scientific health facts and principles as these apply to the further improvement of personal, family, and community health. Prerequisite: Undergraduate courses beyond the elementary level in the biological and physical sciences and in health education. 1 unit.
401. **Problems in School Health Education.** History, philosophy, principles, and practices of school health education in its three main phases: health service, healthful school environment, and health instruction, including evaluation. 1 unit.
403. **Problems in Public Health.** Deals with the basic facts and principles of public health at the local, state, and national levels, including the relationships between public health departments, voluntary health agencies, and the school health program. 1/2 or 1 unit.
404. **Trends and Issues in Sex Education.** A critical analysis of current trends and basic issues of sex education; study of present status of sex education in the United States and selected foreign countries; a critical analysis of philosophy, principles, methods, and current problems. Prerequisite: Undergraduate courses beyond the elementary level in the biological and social sciences, Health Education 285 or equivalent, or consent of instructor. 1 unit.
490. **Seminar.** Student presentation of thesis reports in health and safety education; informal discussions, lectures, and critical analysis of current problems in health and safety education. Prerequisite: Health Education 495. 0 credit.
493. **Special Projects.** Independent research on special projects. 1/2 to 2 units.
495. **Research Methods in Health and Safety Education.** Special emphasis on research orientation and methods; experimental design; processing and analysis of data; selection

of research problems and preparation of thesis; current research literature in health and safety education. Prerequisite: Educational Psychology 390 or equivalent. 1/2 or 1 unit.

499. **Thesis Research.** Preparation of theses in health and safety education. Prerequisite: Health Education 495. 1/2 to 2 units.

Safety Education

199. **Undergraduate Open Seminar.** 0 to 9 hours.
280. **Safety Education.** Understanding and appreciating the place of safety in modern life, and the teaching of safety in the elementary and secondary schools; need for psychological considerations, planning, methods of teaching, safe school environment, liability, materials, safety education for elementary and secondary schools, a safety program for areas outside the school, human experience, and testing and evaluating. 3 hours.
284. **Driver Education.** Cause and extent of highway accidents; laws and regulations; method of instructing high school students in the proper attitudes, habits, and skill in driving; demonstrations and practice in the use of a dual control car; psycho-physical testing equipment. Prerequisite: Up-to-date driver's license; junior standing; proficiency in driving automatic and standard transmission vehicles. 3 hours.
289. **Safety Education Field Work.** Supervised field experiences in official, voluntary, and professional safety agencies. Designed to give students in public safety education work experience in actual field situations. During the junior or senior year or during the summer, students work for one semester in University-approved safety agencies for a minimum of sixty hours of field work. Prerequisite: Senior standing in public safety education. 0 credit.
294. **Advanced Traffic Safety Education.** Designed to provide advanced preparation in principles and practices of driver and traffic safety education for teachers, supervisors, and administrators. Includes a study of the relationship of psychology, sociology, and engineering to driver education and traffic safety; modern methods and materials; traffic legislation and enforcement; laboratory work with various psychophysical tests; a critical consideration of current research findings. Field trip and two hours per week laboratory to be arranged. Prerequisite: Safety Education 284 or consent of instructor. 3 hours.
402. **Problems in Safety Education.** Philosophy of safety: traffic, recreation, home, and industrial safety facts and figures; the safety problem and its relation to education; organization of safety education programs; methods of teaching; legal aspects; research problems. 1 unit.

Hebrew

(See Classics)

Hebrew, Modern

(See Linguistics)

HIGHER EDUCATION

Chairman of Division: Professor E. F. ANDERSON

Division Office: 341 Armory

442. **The Junior College.** Same as Vocational and Technical Education 442. The place of the junior college in the modern program of public education; social, economic, and other changes responsible for development of post-secondary education as found in junior colleges, area vocational schools, and technical institutes. 1 unit.

- 443. The College Student.** Study of the characteristics and development of college students, the institutional contexts in which they operate, and the interaction of students with the college environment. 1 unit.
- 449. Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the division chairman prior to enrollment. 1/2 to 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
- 467. The American College and University.** Introduction to higher education as a subject—its history, purposes, leaders, literature. Special attention to conceptual framework in which the further development of this subject can progress. 1 unit.
- 477. Student Personnel Work in Higher Education.** Study of the theoretical foundations and principles underlying the practice of student personnel work. The role and function of student personnel workers are investigated in terms of their relationship to various goals, philosophies, issues, trends, research. 1 unit.
- 478. The Administration of Student Personnel Work.** Structural arrangements for meeting student-oriented needs in the American college (including the junior college) and university. Special attention is given to the role of the chief administrative officer for student affairs. 1 unit. Prerequisite: Higher Education 477 or equivalent.
- 479. Organization and Control of Higher Education.** Organizational patterns whereby colleges and universities seek to accomplish their purposes; agencies involved in the control of higher education. 1 unit. Prerequisite: Higher Education 442 or 467, or equivalent.
- 480. Internship in the Administration of Higher Education.** Designed to provide supervised direct experience in the administration of higher education. Students, with the aid of the faculty in higher education, select the institution and position most relevant to their career goals. No more than two units may be offered toward an advanced degree. Prerequisite: Consent of instructor. 1 unit.
- 490. Seminar for Advanced Students of Education.** Open only to students who have been admitted for doctoral study in higher education. Sections are usually offered in the following fields: philosophy of higher education, current problems of higher education, history of higher education. Prerequisite: Higher Education 442 or 467 or consent of instructor. 1 unit. No more than 1 unit per section may be counted toward any degree in one semester.
- 491. Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Prerequisite: Consent of instructor. 1 unit.
- 499. Thesis Research.** Individual direction of research and thesis writing. Prerequisite: Admission as a doctoral candidate in higher education. 0 to 4 units (summer session, 0 to 2 units).

Hindi

(See Linguistics)

HISTORY

Chairman of Department: Professor W. U. SOLBERG

Department Office: 309 Gregory Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty-four hours in history, all in courses at the 200 and 300 levels: one

freshman-sophomore survey course sequence (History 111-112, 131-132, 151-152, 171-172, 173-174, 181-182) or equivalent must be taken, as a prerequisite to the major. The courses offered must include at least twelve hours in an area of specialization and at least six hours in a second area. The following areas may be selected: Ancient, Medieval, and Renaissance; Europe Since 1500; United States and Latin America; Asia, Near and Middle East, and Africa. All majors are required to take History 298; to be eligible for this course, each major must have had at least fourteen hours in history, six of which must be in courses on the advanced level.

Minors: Twenty hours, not including more than four hours open to freshmen, in one or two of the following: ancient or modern language, excluding elementary courses 101 and 102, anthropology, economics, English and American literature, geography, library science, philosophy, political science, psychology, and sociology. One of the curricula in Asian studies, in Latin-American studies, in Russian language and area studies, or in medieval civilization is also accepted as a sole minor, excluding the courses in history.

Departmental Distinction: The fundamental goal of the Honors Program of the Department of History is to provide the opportunity for potential and actual departmental majors of marked ability and high standing (4.0 or better) to pursue a program focused on history and at the same time especially suited to the student's own interests. Once admitted to the program, and after the satisfaction of a few basic requirements, the usual departmental course requirements may, on petition, be modified according to the student's needs. The program is concerned essentially with the student who wishes a good liberal education in history and who is able to assume the responsibilities of independent study. The program is not designed for the production of future graduate students. For further information, consult Professor B. D. Hill, 446 Gregory Hall.

111. **History of Western Civilization to 1815.** Europe from the age of the great discoveries to the close of the Napoleonic Wars. 4 hours.
112. **History of Western Civilization, 1815 to the Present.** Development of European nationalism, liberalism, and imperialism; World War; reconstruction. 4 hours.
131. **History of England to 1688.** A survey of the political and constitutional, social and economic, church and cultural, and imperial history of the British people from the beginning of English history through the revolution of 1688. 4 hours.
132. **History of England, 1688 to the Present.** A survey of the political and constitutional, social and economic, diplomatic and imperial, and cultural history of the British people from 1688 to the present. 4 hours.
151. **History of the United States to 1877.** Colonial foundations, movement for independence, early years of the republic. Students are not given credit for both History 151, 260, and 261. 4 hours.
152. **History of the United States, 1877 to the Present.** A century of national life and organization. Students are not given credit for both History 152 and 262. 4 hours.
168. **Indian Civilization and Society.** Same as Anthropology 168. An introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as Anthropology 169. An interdisciplinary introduction to modern South Asian history and society. 4 hours.
171. **History of East Asia, I.** Survey of the development of Chinese and Japanese history, civilization, and institutions prior to the seventeenth century. 4 hours.
172. **History of East Asia, II.** Survey of China and Japan in modern times with particular reference to the modernization and revolutionary processes in east Asia. Prerequisite: History 171. 4 hours.
173. **Islamic History and Civilization in the Near East to 1770.** Development of Islamic beliefs, institutions, and culture in the nuclear Islamic region (the present area of the Arab countries and Israel, Iran, and Turkey) from Mohammed to the age of European expansion. 4 hours.
174. **Islamic History and Civilization in the Near and Middle East Since 1700.** Islamic

- civilization since the age of European expansion; imperialism, Westernization, nationalism, and modernization; covers Arab countries and Israel, Iran, and Turkey. 4 hours.
181. **The Ancient World.** Ancient empires and Greece. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
 182. **The Ancient World.** Rome. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
 198. **Freshman Seminar.** Through research, reports, and discussion in a selected field of historical study, the seminar aims to provide an in-depth understanding of the problems of that field and of the methodology of history as a discipline. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours. May be repeated to a total of 6 hours.
 199. **Undergraduate Open Seminar.** 0 to 9 hours.
 203. **The Age of Localism: The Early Middle Ages.** The failure of imperial Rome and the rise of the Church; the organization of European society on a local basis through manorialism and feudalism. 3 hours.
 204. **The Revival of Europe: The High and Later Middle Ages.** The revival of the economy; the expansion of Europe; the rise of national states. 3 hours.
 211. **The Contemporary World: Political, Ideological, and International Forces.** An interpretation of the contemporary world covering such related problems as the legacy of imperialism, militarism, and world politics, the revolt of the masses, the totalitarian state, nationalism, and internationalism. 3 hours.
 212. **The Contemporary World: Economic, Social, and Cultural Aspects.** An interpretation of the contemporary world covering such related problems as the economics of global power, ideology and social forces, the individual and the modern mind, the collective society, and the personality in history. 3 hours.
 215. **History of North and West Africa.** Surveys major themes and events in the history of North and West Africa from pre-historic times and the peopling of Africa through the advent of Islam, North and West African empires and states in the medieval period, the arrival and departure of European colonial powers, and the re-emergence of independent African states. 3 hours.
 216. **History of East and Southern Africa.** Surveys major themes and events in the history of East and Southern Africa from pre-historic times and the Bantu migrations through the expansion of Islam, east coast commercial traditions, the arrival of European traders, settler and colonial interests and the emergence of same, and continuing efforts of other African peoples to an independent status. 3 hours.
 219. **Survey of Russian History from Early Times to the Present.** Main themes and problems of Russian history from earliest times to the present. Prerequisite: One year of college history or consent of instructor. 3 hours.
 247. **Science in Western Civilization, I.** A history of science from ancient times to the age of Newton. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours.
 248. **Science in Western Civilization, II.** The development of the sciences and scientific principles since the age of Newton. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours.
 253. **Afro-American History to 1877.** History of Africans in the Americas, surveying the African slave trade, slavery in the European colonies of the Americas, early United States slavery, the Afro-American in the Civil War and Reconstruction. 3 hours.
 254. **Afro-American History Since 1877.** History of Afro-Americans in the age of white supremacy, the rise of modern protest organizations, the era of integration, the black power movement. 3 hours.
 260. **Colonial Beginnings and Early United States History to 1815.** A social, economic, and political survey of the region and its relation to the evolving Atlantic community. Students are not given credit for both History 260 and 151. 3 hours.
 261. **The United States in the Nineteenth Century.** History of the United States from 1815

- to 1900. Students who receive credit for History 261 may not receive credit for History 151, 356, or 359. 3 hours.
262. **The United States in the Twentieth Century.** One major emphasis is on foreign policy, including the emergence of the United States as a great power after 1898. A second emphasis is the Progressive movement and recurrent attempts at the reform of American society. Racial and urban problems and the conservation of natural resources are included. Students are not given credit for both History 262 and 152. 3 hours.
271. **French Colonization of North America, 1500–1778.** Exploration and settlement of New France; the British administration of the West to the capture of Kaskaskia by G. R. Clark. Prerequisite: One year of college history. 3 hours.
272. **History of European Women.** Status of women in Europe, cross-culturally and by class, from ancient to modern times, and exploration of the contributions of women as individuals and as groups to the distinctive development of Europe's national cultures. Prerequisite: One year of European history or consent of instructor. 3 hours.
274. **U. S. and World Crisis, 1917 to Present.** The history of American foreign relations since World War I. 3 hours.
275. **History of Latin America to 1824.** A survey of Latin-American history from the discovery of America until 1824. Prerequisite: One year of college history. 3 hours.
276. **History of Latin America Since 1824.** A history of the Latin-American republics from their independence to the present. Emphasis on Argentina, Brazil, Chile, Colombia, Cuba, and Mexico. Prerequisite: One course in college history. 3 hours.
290. **Teaching of History.** Prerequisite: One year of college history; senior standing. 2 hours.
293. **Thesis.** A two-semester independent research project. Prerequisite: History major with senior standing and 4.0 grade-point average; written consent of the honors adviser. This course may be taken by honors students in partial fulfillment of department honors requirements. 3 hours. May be repeated for a total of 6 hours.
295. **Reading Course.** Readings in selected fields in consultation with the instructor. Prerequisite: Junior or senior of high standing; written consent of the honors adviser. This course may be taken by honors students in partial fulfillment of department honors requirements. 2 to 4 hours.
298. **Colloquium in History.** Prerequisite: Enrollment as history major or history teacher trainee; senior standing. 3 hours.
303. **The Near and Middle East in the Twentieth Century.** Great power diplomacy, imperialism, and nationalism; problems of modernization; covers Arab states and Israel, Turkey, and Iran. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or 1/2 or 1 unit.
304. **Medieval Civilization.** Same as Religious Studies 304. Religious and intellectual. Prerequisite: One year of college history or political science. 3 hours, or 1/2 or 1 unit.
305. **The Age of the Renaissance.** Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
306. **The Age of the Protestant and Catholic Reformation, 1500–1648.** Same as Religious Studies 306. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as Religious Studies 307. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
308. **The Europeanization of the Near East, 1768–1914.** Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
309. **Development of Modern Europe: Absolutism and Colonial Expansion, 1648–1789.** Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
310. **The Development of Modern Europe: The French Revolution and Napoleon, 1789–1815.** Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
311. **European History from 1815 to 1871.** Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.

312. **European History from 1871 to 1918.** Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
313. **European History from 1918 to 1939.** A survey of European society from 1918 to 1939, with emphasis on the impact of World War I, the Russian Revolution, fascism, and intellectual trends of the twenties and thirties. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
314. **European History from 1939 to the Present.** A survey of European society since 1939, with emphasis on the impact of World War II, the Cold War, the establishment of the welfare state, and social developments. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
315. **Economic and Social History of Europe to 1815.** A history and analysis of the development of European economy and society from the Middle Ages to the Industrial Revolution; evolving agrarian systems; growth of commercial economies; industrial and technical progress; colonial expansion. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or 1/2 or 1 unit.
316. **Economic and Social History of Europe Since 1815.** A comparative study of the Industrial Revolution in England, France, Germany, and Russia; social, cultural, and demographic consequences of rapid economic change; expanding world economy and modern imperialism. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or 1/2 or 1 unit.
318. **Modern European Diplomatic History, 1789-1890.** The diplomatic history of Europe from the French Revolution to the fall of Bismarck. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
319. **Modern European Diplomatic History, 1890 to the Present.** The diplomatic history of Europe from the fall of Bismarck to the present day. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
320. **Russia from the Earliest Times to Peter the Great.** The political, economic, cultural, and social development of Russia during the Kievan and Muscovite periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
321. **Russia from Peter the Great to 1855.** The political, economic, cultural, diplomatic, and social development of Russia during Imperial times. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
322. **European History, 1918 to the Present.** Major intellectual, social, economic, and political forces which have shaped the experience of twentieth-century Europeans. Students who take History 322 will not be given credit for either History 313 or 314. Prerequisite: One year of college history, political science, or economics. 3 hours, or 1/2 or 1 unit.
323. **Intellectual History of Modern Europe, 1513-1770.** A survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
324. **Intellectual History of Modern Europe, 1770 to the Present.** A survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
325. **Intellectual and Cultural History of Russia to 1825.** Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
326. **Intellectual and Cultural History of Russia from 1825 to the Present.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or 1/2 or 1 unit.
327. **Russia from 1855 to the Bolshevik Revolution of 1917.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or 1/2 or 1 unit.
328. **History of Soviet Russia, 1917 to the Present.** The founding and development of the Soviet regime, with emphasis on political, social, and institutional change since the Russian Revolution. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or 1/2 or 1 unit.

329. **History of Southeastern Europe from the Fourteenth to the Eighteenth Century.** The Byzantine heritage, the Ottoman conquest and its impact on the peoples of the Balkans, and the internal political and cultural history of the Rumanians, South Slavs, Greeks, and Albanians to 1804. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
330. **History of Southeastern Europe Since 1804.** The rise of nationalism and the formation of national states in the Balkans, the decline of the Ottoman Empire, and the political and cultural history of Rumania, Yugoslavia, Bulgaria, Greece, and Albania in the nineteenth and twentieth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
332. **Medieval England.** The religious, social, intellectual, and economic developments in medieval England from the period of the Germanic invasions to the accession of the Tudors. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
333. **England Under the Tudors and Stuarts, 1485–1660.** Traces the principal political, economic, social, religious, and cultural developments in English history from the beginning of the Tudor dynasty to the Restoration of 1660. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
334. **Great Britain Under the Later Stuarts and the Hanoverians, 1660–1815.** The principal political, economic, social, religious, and cultural developments in British history from the Restoration to the end of the Napoleonic wars. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
335. **France, 1815–1900.** The development of France in its various aspects, with special attention to social problems. Prerequisite: One year of college history or consent of instructor. 3 hours or 1/2 or 1 unit.
336. **France, 1900 to the Present.** Political, diplomatic, economic, social, and intellectual developments in France from 1900 to the present. Prerequisite: One year of history or political science. 3 hours, or 1/2 or 1 unit.
337. **Economic History of American Agriculture.** Same as Agricultural Economics and Economics 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: College level course in basic economics or American history. 3 hours, or 3/4 or 1 unit.
338. **History of Cosmology.** A history of man's changing conceptions of the structure and origin of the universe from the ancient creation myths to modern times. The relationships between cosmological theories and developments in the physical sciences, philosophy, religion, and social and cultural factors are explored. Prerequisite: One year of college, history or philosophy, or consent of instructor. 3 hours, or 1/2 or 1 unit.
340. **History of the British Commonwealth in the Twentieth Century, 1901 to the Present.** One year of college history. 3 hours, or 1/2 or 1 unit.
341. **Modern Britain, the Victorian Era, 1815–1900.** A history of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
342. **Modern Britain Since 1900.** A history of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
343. **The Turks and the Ottoman Empire, 1200–1566.** The Seljuk establishment, the Mongols and Ilhanids, Turkish principalities, the rise and conquests of the Ottomans, changing social and economic conditions; foreign relations with special attention to the Mamluks and Safavids; the Ottoman establishment. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
344. **The High Ottoman Empire, 1566–1924.** The Ottomans and Islamic society; the Ottomans and Mediterranean society; Ottoman foreign relations and the development of diplomacy; the decline and dismemberment of the Empire; traditional and westernizing attempts at revival. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.

345. **Constitutional History of England to 1485.** A survey of English legal and constitutional development from about 600 to 1485, with emphasis on the ways in which social and economic development affected the constitution. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
346. **Constitutional History of England Since 1485.** A survey of English legal and constitutional development since 1485 with emphasis on the ways in which social and economic change affected the constitution. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
347. **The Age of Charlemagne.** Same as Classical Civilization 347. The age of Charlemagne and its intellectual, political, social, and cultural significance for Western Europe. Prerequisite: Junior standing or consent of instructor. 3 hours, or 3/4 or 1 unit.
349. **The Scientific Revolution, 1543–1727.** A study of the birth of modern science in the seventeenth century, with special emphasis upon the rise of experimentalism, the growth of mathematical science, and the establishment of the mechanical philosophy. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
350. **History of American Immigration to 1880.** The migrations which peopled Colonial America and the United States and their role in the shaping of American society and culture. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
351. **History of American Immigration Since 1880.** The migrations of the late nineteenth and twentieth centuries and their impact on American society and culture. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
352. **Colonial Beginnings of American Life and Institutions.** A study of the seventeenth- and eighteenth-century colonies. 3 hours, or 1/2 or 1 unit.
354. **The Era of the American Revolution, 1763–1789.** Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
355. **Federalists, Jeffersonians, and the Era of Good Feelings.** United States history from 1789 to 1828, with emphasis on the conflict between nationalism and sectional interests. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
356. **America in the Age of Jackson.** A political, social, and cultural study of the United States from the 1820's to the 1850's, including the rise of sectionalism, manifest destiny, and the Mexican War. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
357. **Economic History of the United States, 1775–1860.** The growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
358. **Economic History of the United States Since 1860.** The growth of American economic life and institutions since 1860. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
359. **Civil War and Reconstruction.** A study of the United States between 1850 and 1877, including the causes of the Civil War, the wartime problems of the North and South, and the efforts to create a new Union following the Civil War. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
360. **History of the United States, 1877–1909.** Prerequisite: One year of college history, political science, or economics. 3 hours, or 1/2 or 1 unit.
361. **History of the United States, 1909–1932.** Prerequisite: One year of college history, political science, or economics. 3 hours, or 1/2 or 1 unit.
362. **History of the United States Since 1932.** Prerequisite: One year of college history, political science, or economics. 3 hours, or 1/2 or 1 unit.
363. **Social History of Industrial America to 1918.** The impact of industrialization, immigration, and urbanization on American society to the end of World War I. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
364. **Social History of Industrial America Since World War I.** A study of the impact of

- industrial technology, business enterprise, immigration, and urbanization of American society. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
365. **The History of Illinois to 1870.** Evolution of a typical midwestern commonwealth with emphasis upon its political, economic, social, religious, and cultural development in the nineteenth century. Prerequisite: One year of college history or consent of instructor. 2 hours or 1/2 unit.
366. **The History of Illinois from 1870 to the Present.** The evolution of a modern American state with emphasis upon its political life, economic growth, social and intellectual problems, and its contribution to the American nation. Prerequisite: One year of college history or consent of instructor. 2 hours or 1/2 unit.
367. **The Trans-Mississippi West.** The history of western expansion since the Louisiana Purchase; the West in the general history of the United States; western economic and political problems. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
369. **Constitutional Development of the United States to 1865.** Prerequisite: One year of college history or political science. 3 hours, or 1/2 or 1 unit.
370. **Constitutional Development of the United States Since 1865.** Prerequisite: One year of college history or political science. 3 hours, or 1/2 or 1 unit.
371. **American Thought and Culture, I.** The impact of fundamental ideas in shaping American culture, character, and institutions from the colonial beginnings to the mid-nineteenth century, with emphasis on Puritanism, the Enlightenment, and romanticism, and on the interplay between religious, scientific, political, social, educational, and artistic thought in the life of the American people. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
372. **American Thought and Culture, II.** The impact of fundamental ideas in shaping American culture, character, and institutions from the mid-nineteenth century to the present, with emphasis on the role of Darwinism and naturalistic thought; political, cultural, religious, and intellectual forces and their interrelations; the American university; the impact of science and technology; and the emergence of neoromanticism. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
373. **History of American Foreign Relations to 1917.** Prerequisite: One year of college history or political science. 3 hours, or 1/2 or 1 unit.
374. **Imperialism, 1870-1919.** A study of the origins and nature of pre-World War I imperialism, using the comparative approach, with emphasis on Great Britain, the United States, and Japan. Prerequisite: One-year survey course in history. 3 hours, or 1/2 or 1 unit.
377. **History of Modern Brazil, 1808 to the Present.** Problems of a neocolonial society. Themes include family structure, slavery, imperialism, modernization, and the crisis of traditional institutions. Prerequisite: One year of college history or enrollment in the Latin-American studies program. 3 hour, or 1/2 or 1 unit.
378. **History of Modern Mexico, 1765 to the Present.** The development of Mexico from the era of Bourbon reforms to the post-revolutionary present. Prerequisite: One year of college history or enrollment in the Latin-American studies program. 3 hours, or 1/2 or 1 unit.
379. **Slavery and Race Relations in Latin America.** Selected topics from the history of slavery and race relations, emphasizing Mexico, the Caribbean, and Brazil. 3 hours, or 1/2 or 1 unit.
381. **Ancient Greek States.** History of the Greek states from the earliest times to 334 B.C. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
382. **Alexander and His Successors.** Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
383. **History of the Roman Republic to 44 B.C.** Prerequisite: One year of college history 3 hours, or 1/2 or 1 unit.
384. **The Roman Empire.** Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.

- 385. Topics in the History of Islam in Africa.** Designed for advanced students with working knowledge of Middle Eastern or Islamic history, sociology, anthropology, or politics who are interested in examining specific historical themes such as religious and legal reform, reaction to conquest, and secularization in Islam, in the context of Africa. 3 hours, or 1/2 or 1 unit.
- 386. Topics of West African History.** Designed for advanced students with a working knowledge of West African history, sociology, anthropology, economics, or politics who are interested in examining specific historical themes such as literacy, social structure and state formation, religious movements, elites and reactions to European occupation, proto-nationalism, nationalism, and the colonial legacy. Prerequisite: History 215 or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 387. Indian History and Civilization to 1707.** Development of Indian civilization to the British conquest; political evolution, religious and philosophical systems, society, art, and literature during Hindu and Muslim periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 388. India in the Age of Imperialism.** Western impact on India from 1498 to 1900. Rise of British raj, national awakening and social change in Victorian India. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 389. India From Ghandi to Independence.** Growth of nationalism, emergence of Muslim separation, and struggle for independence under Ghandi and Nehru. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 390. China Under the Ch'ing Dynasty.** The period of Manchu domination in China (1644–1912). Emphasis is on Chinese reactions to Western influences during the nineteenth century. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 391. A History of China to 906 A.D.** A history of the formative period of the Chinese state, society, and economy. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 392. A History of China, 907–1644.** A history of the early modern Chinese state and society prior to the Western impact. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 393. Chinese Intellectual History from Earliest Times to the Present.** A study of the major ideas and schools of thought as they have affected the course of Chinese history and the development of its institutions. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 394. Twentieth-Century China.** Chinese state and society in revolutionary transition. Emphasis on the Nationalist and Communist revolutions and their results. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 395. Premodern Japan.** Japanese history from its origins to 1800; evolution of the traditional society, stressing institutional and cultural problems of ancient and “feudal” Japan. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 396. Modern Japan.** Japanese history since 1800; institutional and cultural problems connected with modernization—continuity and change in the traditional order, Western pressure, the Meiji restoration, rise and fall of empire, and creation of a modern society. Prerequisite: One year of college history or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 397. History and Thought of Japanese Buddhism.** Same as Religious Studies 397. The Japanese response to Buddhism and its influence on Japanese life and culture. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 399. History and Thought of Chinese Buddhism.** Same as Religious Studies 399. The interaction of Buddhism with Chinese thought and institutions from its introduction to the present. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 403. Problems in European History to 1815.** 1 unit.

- 404. Problems in Modern European History Since 1815. 1 unit.
- 407. Problems in American History to 1865. 1 unit.
- 408. Problems in American History Since 1865. 1 unit.
- 409. Problems in Asian History. 1 unit.
- 411. Seminar in Ancient History: Greece. 1 unit.
- 413. Seminar in Ancient History: Rome. 1 unit.
- 415. Seminar in Medieval History. 1 unit.
- 417. Seminar in Renaissance History. 1 unit.
- 418. Seminar in Reformation History. 1 unit.
- 419. Seminar in European History, 1648 to 1815. 1 unit.
- 421. Seminar in European History Since 1815. 1 unit.
- 423. Seminar in English History to 1688. 1 unit.
- 425. Seminar in English and British Empire History Since 1688. 1 unit.
- 427. Seminar in Russian History. 1 unit.
- 441. Seminar in Near and Middle Eastern History. 1 unit.
- 443. Seminar in South Asian History. 1 unit.
- 445. Seminar in East Asian History. 1 unit.
- 451. Seminar in Early American History to 1789. 1 unit.
- 453. Seminar in American History Since 1789. 1 unit.
- 461. Seminar in Latin-American History. 1 unit.
- 471. Seminar in the History of Science. 1 unit.
- 496. History of Historiography. Introduction to the great historians from early times to the present. 1 unit.
- 497. Reading Course. Directed reading in special fields. Open only to students with a master's degree or equivalent, who are preparing for the preliminary examination in history and who need instruction in areas not provided by current course offerings. Prerequisite: Master's degree or equivalent; consent of instructor. 1 unit.
- 498. Problems in the Teaching of College History. Prerequisite: Candidate for Ph.D. degree in history. 1/2 unit.
- 499. Thesis Research. Individual direction in research and guidance in writing theses for advanced degrees. 0 to 4 units.

HISTORY AND PHILOSOPHY OF EDUCATION

Chairman of Department: Professor J. R. BURNETT

Department Office: 363 Education Building

- 199. Undergraduate Open Seminar. 0 to 9 hours.
- 201. Foundations of American Education. A study of the problems of formulating and justifying aims and policies in American education, of designing and systematizing the school curriculum, of organization and support of the public school system, and of the teaching-learning process. These problems are examined in terms of relevant materials derived from sociology, social philosophy, and axiology. Prerequisite: For students not in elementary education, Secondary and Continuing Education 101 or Vocational and Technical Education 101 and Psychology 100; for students in elementary education, Psychology 100 only. 2 hours.
- 249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 percent of class in grade-point average; demonstrated writing competence.

tence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
300. **The History of Education.** Brief introductory survey of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance. Special emphasis on the relation of educational trends to broader social, economic, political, and intellectual movements. Prerequisite: Junior standing. 3 hours or 1/2 unit.
301. **Philosophy of Education.** Based on Dewey's *Democracy and Education*, this course is an examination of experimentalist philosophy in its bearings on educational problems; nature and aims of education in a democratic society; relation of the individual to society; interest and discipline; play and work; freedom and control; subject matter and methods. 2 hours or 1/2 unit.
302. **History of American Education.** The development of American education in relation to political, social, and cultural developments. Special attention is given to the influence of movements in the cultural environment upon evolving conceptions of educational theory and practice. 2 hours or 1/2 unit.
303. **Comparative Education.** An introduction to the cross-cultural, cross-national study of educational institutions and their relationship to society. Focuses on schooling in both developing and industrialized nations. Prerequisite: Consent of instructor. 2 hours, or 1/2 to 1 unit.
304. **Social Foundations of Education.** An introductory survey of the interrelationship between school and society and of the impact on public education of the major social trends and forces operating in our society. 2 hours or 1/2 unit.
305. **History of Educational Ideas.** Through a study of selected educational theorists and intellectual movements, this course provides familiarity with the major educational ideas of the past, as well as historical perspectives on current issues and problems in education. Readings in Plato, Quintilian, St. Augustine, Loyola, Comenius, Rousseau, Pestalozzi, Froebel, Herbart, Dewey, and others. 2 hours or 1/2 unit.
306. **Introduction to Aesthetic Education.** A philosophic introduction to the problems of teaching for critical judgment and appreciation. Materials from aesthetics, art history, and criticism are examined for their relevance to the problems of aims, curriculum, organization, and teaching-learning, with special attention to problems of interrelated arts and humanities programs. Designed for prospective teachers of art, music, literature, and related subjects. 2 or 3 hours, or 1/2 or 1 unit.
307. **Aesthetics, Mass Media, and Education.** An introduction to the philosophic problems of teaching for developing critical judgment and appreciation of the mass media. Materials relevant to the educational problems of aims, curriculum, organization, and teaching-learning are drawn from aesthetics, communication theory, and the social sciences. 2 or 3 hours, or 1/2 or 1 unit.
315. **Sociology of Education.** Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share Western civilization. Prerequisite: Sociology 100 or Sociology 151 and 152. 3 hours, or 1/2 or 1 unit.
385. **Anthropology of Education.** Introduction to the contribution of anthropology to the cross-cultural study of education. Includes discussion of material from representative cultures ranging from primitive social groups to present-day national states; education of minority ethnic and subordinate cultures receives special attention. Emphasis is placed on both informal and formal education as cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or 1/2 or 1 unit.
386. **Education and International Relations.** An analysis of the role of education in international relations. Emphasizes the policies and programs of the major aid-giving nations, the competition among these nations, and the results of foreign assistance programs in

the developing countries. Prerequisite: History and Philosophy of Education 303 or consent of instructor. 2 to 4 hours, or 1/2 to 1 unit.

400. **Problems of Educational Theory.** Analysis of the kinds of problems encountered in constructing an educational theory, and of relations between educational theory and other disciplines, especially philosophy and the social sciences. Prerequisite: History and Philosophy of Education 301 or 305. 1 unit.
401. **Modern Theories of Education.** A critical analysis and examination of the theories of education represented by the work of Robert M. Hutchins, Henry C. Morrison, the Harvard Committee, and William H. Kilpatrick. 1 unit.
402. **Educational Movements in the Twentieth Century.** An historical study of significant educational trends during the past sixty years, with special reference to their influence on American education; an analytical examination of the principal transition movements in the last decade of the nineteenth century and of efforts to solve the problems since 1900. Prerequisite: Consent of instructor. 1 unit.
403. **The Historical Foundations of American Educational Thought.** A study of the evolution of educational theories and philosophies since the eighteenth century, with particular reference to their impact upon educational developments in the United States. Effort is made to give a broad view of the general growth of American educational thought, with sufficient time devoted to selected major educational theorists, or schools of thought, to permit adequate exploration of their fundamental ideas and the relation of these ideas to significant intellectual currents in American culture. Prerequisite: Consent of instructor. 1 unit.
404. **Seminar in Educational Classics.** Reading and group discussion of a limited number of the most important writings in educational philosophy which have had a profound influence on the progress of educational thought and practice. Prerequisite: One graduate course in philosophy of education and one in history of education, or consent of instructor. 1 unit.
405. **Foundations of Aesthetic Education.** A philosophical approach to the problems of teaching for appreciation in formal education. Appraisal of the status of aesthetic education, its nature and function, and its relation to other types of education are the major areas investigated. Prerequisite: History and Philosophy of Education 306 or consent of instructor. 1 unit.
406. **Seminar in the History of Education.** Intensive group study of a small number of selected problems to assist individual students to develop an understanding of and the ability to use the techniques of historical research in furthering such study. Problems studied in any one semester are selected in the light of the interests and previous training of the group of students enrolled. Prerequisite: Two courses in the history of education and one course in the philosophy of education, or consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years.
407. **Logical Foundations of Methods.** A study of the application of principles of logic in methods of instruction. This study involves the treatment of the problems of educational direction and control in processes of inference, judgment, and knowing, examined from the standpoint of recent developments in pragmatism. Prerequisite: Consent of instructor. 1 unit.
408. **Advanced Philosophy of Education.** A systematic exploration of knowledge and inquiry as they relate to problems of formulating educational policy, curriculum design, organization of the school system, and teaching-learning. Selected materials in the history of epistemology are examined and emphasis is placed on a critical appraisal of significant trends in educational theory. Prerequisite: History and Philosophy of Education 301 or 305 or advanced graduate standing; consent of instructor. 1 unit.
409. **Advanced Philosophy of Education.** A study of the nature of value as it relates to problems of formulating and justifying educational aims and policies, curriculum design, organization of the school system, and teaching-learning. Selected materials in ethics, value theory, and aesthetics are used in the critical appraisal of significant trends in educational theory. Prerequisite: History and Philosophy of Education 301 or 305 or advanced graduate standing; consent of instructor. 1 unit.

- 410. Seminar in Theories of Educational and Social Change.** Designed to help prospective educational leaders acquire an understanding of current theories of social change as these relate to the work of the profession of teaching. There is now an extensive body of knowledge on the nature and control of social change. This needs to be made available to all prospective educational leaders in order that they may go about their duties with greater understanding and skill. Designed to aid students in bringing this knowledge to bear upon the problems of leadership in educational and social change. Prerequisite: Candidacy for Ed.D. or Ph.D. in education. 1 unit.
- 449. Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
- 483. Methods in Comparative Education.** Methodologies and concepts involved in comparative educational systems in selected countries; topics related to the role of normative, institutional, and environmental patterns in shaping educational policies related to administration, curriculum development, diversification and expansion of educational opportunity. Prerequisite: Anthropology 373 or Sociology 300, History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.
- 484. Education in the Industrialized Nations.** An examination of education and national policy in industrialized nations. Topics include education and political integration, socialization, economic growth and manpower development, social status and mobility, and educational planning. Particular attention is given Western Europe, the U.S.S.R., and North America. Prerequisite: History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.
- 485. Education in the Developing Countries.** An analysis of the role and functions of education in social, political, and economic development, with particular reference to the new and the developing countries. Prerequisite: History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.
- 490. Seminar for Advanced Students of Education.** Seminar in history and philosophy of education open only to persons who have been admitted for doctoral study in history and philosophy of education. Sections are usually offered in the following fields: (a) history of education, (b) philosophy of education, (c) comparative education, (d) social foundations of education, (e) philosophy of educational research, (f) historical methods in education. Prerequisite: For section (c) only, History and Philosophy of Education 483 or consent of instructor. 1 to 2 units. No more than 1 unit per section may be counted toward a degree in any one semester.
- 491. Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
- 499. Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

History of Art (See Art)

HOME ECONOMICS

Acting Head of Department: Professor H. D. TURNER

Department Office: 260 Bevier Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Departmental Distinction: A home economics student in the College of Liberal Arts and Sciences, eligible for graduation with honors, shall be certified for Departmental Distinction if she has satisfactorily completed Home Economics 291 or 292.

105. **Child and Family.** An introductory course in child development and family relationships designed to contribute to the better understanding of the essentials of parent-child relationships and the principles of growth through family living. 4 hours.
120. **Elementary Nutrition.** Fundamental laws of human nutrition; application to the selection of an adequate diet. For non-home economics majors. Prerequisite: Sophomore standing. 2 hours.
125. **Food Selection and Preparation.** An elementary study of foods in relation to market selection, preparation methods and standards; comparative costs and food values; principles of meal planning. For non-home economics majors. Prerequisite: Sophomore standing. 3 hours.
132. **Foods and Nutrition.** Principles of nutrition and food preparation. Provides experience, through readings, discussion, and laboratory practice, in selection and preparation of foods to meet nutritional needs of individuals. Prerequisite: Credit or registration in Chemistry 101. 3 hours.
133. **Food Management.** A study of factors involved in management of food for the family; food costs and buying; meal planning and service. Prerequisite: Home Economics 132. 2 hours.
160. **The Home and Its Furnishings.** Design fundamentals involved in the development and selection of family housing to meet human needs. Aesthetic, social, economic, and functional aspects of residential environment are considered. 4 hours.
171. **Home Management.** Principles of management related to the resources of the student and of the family with emphasis on the use of time, energy, and money. 2 hours.
182. **Clothing Laboratory.** Fundamentals of clothing construction; fitting problems in the selection of ready-to-wear. 2 hours.
183. **Consumer Textiles.** Analysis of textile products as a basis for consumer choice. 2 hours.
184. **Clothing Section.** Design and economic aspects in the selection of clothing. Prerequisite: Credit or registration in Art 185. 2 hours.
190. **Freshman Honors Seminar: International Problems as Related to Agriculture.** Same as Agriculture 190. Lectures and discussion dealing with the broad national and international problems of agriculture. The group explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
192. **Honors Seminar: Science, Food, and World Population.** Same as Agriculture 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival. The group explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
193. **Textile Arts for Occupational Therapy.** Creative work in the textile arts, both decorative and structural, as a basis for utilization in therapeutic treatment. Limited to occupational therapy students. Prerequisite: Art 185. 4 hours.
196. **Weaving.** Principles of handweaving; origin, development, and appreciation of the art of weaving. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours.

202. **Laboratory in Child Development.** Observation of young children in an environment to promote learning. Prerequisite: Home Economics 105; Psychology 100 or 103. 2 hours.
203. **Child Development: Period of Infancy and Early Childhood.** A study of the growth and development of young children; their biological and psychological needs and the environmental influences affecting their development and relationships with others. The course is designed to give an understanding of the developmental sequences and the basic principles of child care and training. Prerequisite: Home Economics 105 or Psychology 216. 4 hours.
210. **Family Relationships.** Same as Anthropology 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; examination of selected family adjustment problems. 3 hours.
220. **Principles of Nutrition.** Nutritive value of foods and metabolism of essential nutrients, application of principles of nutrition to the requirements of normal individuals throughout the life cycle. Prerequisite: Chemistry 102; Home Economics 132; Physiology 103. 3 hours.
231. **Foods.** Composition and behavior of foods; application of chemistry and other physical sciences to principles of food preparation. Prerequisite: Chemistry 102; Home Economics 133. 3 hours.
240. **Quantity Food Production and Service.** Application of the principles of food preparation and service to institutional and commercial feeding. Credit is not given for both Home Economics 240 and 351. Prerequisite: Food handlers certificate; Economics 108; Home Economics 231; consent of instructor. 3 or 5 hours.
260. **Interiors and Furniture, I.** The development of residential environments from prehistoric to the nineteenth century as seen through the study of architecture and furniture design. The adaptation and use of period styles in contemporary interiors are considered. Prerequisite: Art 119 or 185, or equivalent. 3 hours.
261. **Interiors and Furniture, II.** Continuation of Home Economics 260. A study of the development of residential environments of the nineteenth and twentieth centuries. Prerequisite: Home Economics 260. 3 hours.
262. **Interior Design.** Designing of interiors and their components with emphasis on design theory, presentation techniques, and evaluation of design concepts. Prerequisite: Home Economics 160 and 261; Art 118, 120, and 123. 3 hours.
263. **Textile Design—Printing.** Creative design developed from historical and traditional background; exploration of various printing techniques on fabric, such as block, stencil, and silk screen processes; an analysis of contemporary American design. Prerequisite: Art 120 or 186; consent of instructor. 3 hours.
270. **Family Financial Management.** Application of managerial principles to family finances. Factors affecting the acquisition and use of income, plans for spending, and saving during various periods in the family cycle, and relationship of income to the economic situation are considered. Prerequisite: Economics 103 or 108; Home Economics 171. 3 hours.
271. **Home Management.** Methods for determining the use of time, energy, money, and materials in the home; relationship between various aspects of homemaking. Emphasis on plans for use of time and money; buying problems. For non-home economics majors. 2 hours.
273. **Home Management.** Application of managerial principles to specific situations during the four-week residence in a home management house. Experiences in meal management, use of equipment, and evaluation of some homemaking activities. Prerequisite: Economics 103 or 108; Home Economics 105, 133, 160, 171, 183, 184; consent of instructor. 3 hours.
280. **Household Textiles.** Selection of household textiles for consumer use. Prerequisite: Home Economics 183. 2 hours.

281. **Non-Textile Apparel and Accessory Materials.** Consumer information about the selection and care of apparel and accessory items of leather, fur, plastic, and metal. Prerequisite: Home Economics 183. 2 hours.
284. **Costume Design.** Creative clothing design using the art principles through the media of sketch and color; designing clothing suited to figure type and personality; understanding the influence of design on contemporary clothing. Prerequisite: Art 120 or 186; Home Economics 184. 2 hours.
285. **History of Costume.** Costumes and their settings from the early Egyptian period through the nineteenth century. 2 hours.
286. **Clothing Design: Flat Pattern.** Designing by drafting patterns using sources of design inspiration appropriate for this process; fitting a basic pattern to use in designing and making a garment. Prerequisite: Art 120 or 186; Home Economics 182, 183, and 184. 3 hours.
287. **Consumer Clothing Problems.** Psychological, sociological, economic, and hygienic aspects of consumer reactions to clothing. Prerequisite: Economics 108; Home Economics 183 or 184; Psychology 100 or 103; Sociology 100. 2 hours.
291. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.
292. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.
301. **Advanced Problems in Home Guidance of Children.** Emphasis is placed upon the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view to helping students understand the less obvious and more subtle aspects of child development, to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. Prerequisite: Home Economics 202 and 203; consent of instructor. 3 hours, or 1/2 or 1 unit.
313. **Economics of Consumption.** Same as Economics 313. An analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or 3/4 or 1 unit.
320. **Diet in Diseases.** The application of the science of nutrition to the maintenance of optimum health and the role of nutrition in the prevention and treatment of disease. Prerequisite: Home Economics 220. 3 hours or 3/4 unit.
322. **Physical Growth and Nutrition.** Lecture, readings, and discussions. Prerequisite: Home Economics 220; senior standing; consent of instructor. 2 hours or 1/2 unit.
323. **Recent Advances in Foods and Nutrition.** New developments in foods and nutrition. Readings, lectures, and discussions. Prerequisite: Chemistry 102; Home Economics 220 and 231; Physiology 103. 2 hours or 1/2 unit. Offered in the summer session only.
324. **Problems in Nutrition.** Same as Food Science 324. Discussions and investigations. Prerequisite: Biochemistry 350 and 355 or Biochemistry 354 and 356; Home Economics 220; senior standing. 3 to 5 hours, or 1/2 or 1 unit.
326. **Presentations: Principles and Techniques.** Selection of problems and organization of materials for demonstrations and other presentations in home economics subject matter areas. Field trip; estimated cost, \$15.00. Prerequisite: Senior standing; consent of instructor. 3 hours or 1/2 unit.
330. **Experimental Foods.** A consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. Prerequisite: Home Economics 231; Microbiology 100 and 101. 3 hours, or 3/4 or 1 unit.
331. **Problems in Foods.** Individual problems in food preparation and preservation. Prerequisite: Home Economics 330. 3 hours or 3/4 unit.
345. **Institution and Restaurant Management: Food Purchasing and Equipment Selection.** Purchasing food and selecting equipment for quantity food service; factors affecting the purchase of food; relationship of floor plans and equipment to service. Field trip; estimated cost, \$20.00. Credit is not given in this course in addition to Home Economics 351. Prerequisite: Credit or registration in Home Economics 240; Economics 108. 3 hours or 1/2 unit.

- 349. Music in Early Childhood.** Same as Music 349. A detailed consideration of the music program in nursery schools, kindergarten, and the primary grades. Topics covered include the nature of early musical responses, objectives, and experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate level in music education or child development. 2 hours or 1/2 unit.
- 350. Institution and Restaurant Management: Organization and Administration.** The organization and administration of food service operations; management problems in various types of food service, personnel, costs, sanitary control. Field trips; estimated cost, \$20.00 to \$25.00. Credit is not given in this course in addition to Home Economics 351. Prerequisite: Home Economics 220 and 240. 4 hours or 1 unit.
- 351. Special Problems on Group Feeding.** For individuals interested in refreshing and strengthening knowledge in group feeding. Lectures discussions, and laboratory practice in quantity food management. Food handlers certificate required. Credit is not given in this course in addition to Home Economics 240, 345, or 350. Prerequisite: Home Economics 220 and 231, or equivalent; consent of instructor. 3 hours or 1/2 unit. Offered in the summer session only (four weeks).
- 355. Specialized Quantity Food Production and Management.** Advanced application of food production and management principles to specific food service demands. Emphasis is on artistry in preparation, serving, and merchandising high quality food in quantity. Prerequisite: Home Economics 240, credit or registration in Home Economics 350, or consent of instructor. 3 hours or 3/4 unit.
- 361. Development and Function of Family Housing.** Same as Agricultural Mechanization 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials, and structure, economic influences, costs, and adaptations; personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural engineering students, no prerequisite). 3 hours or 3/4 unit.
- 370. Family Economics.** Same as Agricultural Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or 3/4 or 1 unit.
- 375. Home Equipment.** A survey course in which the basic principles related to the selection, use, and care of household equipment are considered. Individual problems include an evaluation of sources of information on equipment and equipment performance tests. Prerequisite: Home Economics 171; six advanced hours in home economics including one of the following: 231, 273, 380; senior standing; consent of instructor. 3 hours or 1/2 unit.
- 377. Cooperative Extension: Home Economics.** The philosophy, history, and organization of the cooperative extension service. Consideration of program development, methods of presentation and evaluation with emphasis on socio-economic characteristics of state and county. Prerequisite: Economics 108; Psychology 100 and Sociology 100, or Educational Psychology 211, or Agriculture 206; consent of instructor. 3 hours or 1/2 unit.
- 378. Problems in Home Management, Housing, and Interior Design.** Individual investigations and reports of specific problems in the fields of home management, family housing, or interior design. Prerequisite: Home Economics 262 or 270; senior standing; consent of instructor. 3 hours, or 3/4 to 1 unit.
- 379. Problems in Family and Consumption Economics.** Individual investigations and reports of specific problems in the field of family and consumption economics. Prerequisite: Economics 102 or 108; a course in applied statistics; Home Economics 313, 370, or consent of instructor; senior standing. 3 hours, or 1/2 or 1 unit.
- 380. Advanced Textiles.** The effect of the physical and chemical structures of textile fibers on their properties, manufacturing processes, use, and care. Prerequisite: Home Economics 183; Chemistry 102. 4 hours or 1 unit.
- 386. Clothing Design: Draping.** Designing by draping inspired by appropriate design sources; understanding of fitting principles through fabric manipulation; design effects

maintained in garment construction. Prerequisite: Home Economics 285 or consent of instructor; Home Economics 286. 4 hours or 1 unit.

388. **Problems in Textiles and Clothing.** Investigation and report of individual problems in the field of textiles and clothing. Prerequisite: Home Economics 286 or 380, or Business Administration 212; minimum grade-point average of 3.5; senior standing in home economics or consent of instructor. 3 hours, or 1/2 or 1 unit.
395. **Fashion Analysis.** A study of fashion terminology, selected designers, garment manufacturing techniques, and methods of fashion promotion used in retail outlets. Field trip; estimated cost, \$10.00. Prerequisite: Advertising 281; senior standing; consent of instructor. 3 hours or 1/2 unit.
410. **Problems in Family Living.** Family relationships and their significance to the growth of family members. Prerequisite: Home Economics 210. 1 unit.
418. **Seminar in Child Development.** Advanced problems in child development. Prerequisite: Home Economics 301. 1 unit.
419. **Seminar in Family Relationships.** Critical evaluation of research literature in the field of marriage and family relationships. Prerequisite: Home Economics 410. 1 unit.
422. **Seminar in Nutrition.** A study of recent literature in nutrition. Prerequisite: Undergraduate degree in home economics, with emphasis on foods and nutrition, or comparable background in biochemistry, microbiology, physiology, or other biological science. 1/2 or 1 unit.
423. **Problems in Human Nutrition.** Methods of assessing nutritional status of humans. Prerequisite: Home Economics 324 or equivalent. 1/2 or 1 unit. Offered in 1972-1973 and in alternate years.
432. **Seminar in Foods.** Review of current literature in foods research. Prerequisite: Undergraduate major in foods and nutrition, chemistry, microbiology, or physiology; consent of instructor. 1/2 or 1 unit.
470. **Seminar in Family and Consumption Economics.** Same as Agricultural Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 102 or 108 and a course in applied statistics; Home Economics 313, 370, or consent of instructor. 1/2 or 1 unit.
480. **Seminar in Textiles.** Current literature related to development in the production, use, and care of textile fabrics. Prerequisite: Home Economics 380 or equivalent; consent of instructor. 1/2 or 1 unit.
487. **Seminar in Clothing.** Study and discussion of research in clothing from the aspects of psychological and sociological factors contributing to the effect of clothing on the development of individuals and on family and community group reaction. Prerequisite: Undergraduate curriculum with majors in textiles and clothing, home economics education, home economics extension, or general home economics. 1/2 or 1 unit.
493. **Advanced Studies in Home Economics.** Library or experimental research on specific problems of limited scope. Work may be taken in the following subjects: (a) child and family, (b) family and consumption economics, (c) family housing, (d) foods, (e) nutrition, (f) textiles and clothing. This is one of the courses which may be taken in addition to eight units required for a master's degree by students who do not write a thesis. 1/2 or 1 unit.
499. **Thesis Research.** Work may be taken in the following subjects: (a) child and family, (b) family and consumption economics, (c) family housing, (d) foods, (e) nutrition, (f) textiles and clothing. 0 to 4 units.

HORTICULTURE

Head of Department: Professor C. J. BIRKELAND

Department Office: 124 Mumford Hall

100. **Introductory Horticulture.** The principles and practices involved in the production of fruits, vegetables, and ornamental plants. Lectures and discussions. Prerequisite: Botany 100. 3 hours. ZYCH.
110. **Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Dairy Science 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. ALEXANDER and others.
122. **Greenhouse Management.** Principles of greenhouse operation, soils, fertilizers, potting, watering, ventilating. Lectures, reference readings, and greenhouse practice. Prerequisite: Credit or registration in Botany 100. 3 hours. SAUPE.
199. **Undergraduate Open Seminar.** 1 to 5 hours.
210. **Home Grounds Planning and Design.** Practice of developing home grounds, emphasizing analysis and practical solutions of typical site problems, and evaluating plants and garden structures as elements in home grounds planning and design. Prerequisite: Landscape Architecture 152 or consent of instructor. 4 hours. NELSON.
211. **Home Grounds Development and Construction.** Continuation of Horticulture 210, with emphasis on development of home grounds and construction methods and techniques. Prerequisite: Horticulture 210 and Landscape Architecture 152, or consent of instructor. 3 hours. NELSON.
212. **Landscape Contracting.** Interpretation of the landscape architect's plans and specifications, estimating quantities of materials, computing costs and procedures for bidding and executing landscape construction. Prerequisite: Horticulture 211; Landscape Architecture 152. 3 hours. GARTNER, NELSON.
221. **Plant Propagation.** Principles, methods, and practices employed in the propagation of plants, emphasizing anatomical features and physiological principles involved in sexual propagation (seeds) and asexual propagation (division, cuttings, budding, grafting, etc.). Prerequisite: Botany 100 or equivalent. 3 hours. GARTNER.
223. **Floricultural Crops Production.** Commercial production of major cut flower crops in the greenhouse and field. Prerequisite: Horticulture 122. 3 hours. Offered in 1973-1974 and in alternate years. CULBERT.
224. **Floricultural Crops Production.** Commercial production of pot plants and minor greenhouse and field grown cut flowers. Prerequisite: Horticulture 223. 3 hours. Offered in 1973-1974 and in alternate years. CULBERT.
225. **Ornamental Gardening.** The theory and practice of planting and maintaining ornamental plants in public and private landscaped areas. The functional use of ornamental woody plants, flowers, and turf in the landscape. Not open to students in the ornamental horticulture curriculum. 3 hours. NELSON.
226. **Bedding and Foliage Plants.** Commercial production and use of tender ornamental plants grown for outdoor bedding purposes, and of foliage plants suitable for indoor decorative uses. Prerequisite: Horticulture 122 or Botany 100. 3 hours. Offered in 1972-1973 and in alternate years. FOSLER.
230. **Garden Flowers.** The place of herbaceous flowers in the landscape, their cultural requirements and uses; the planning of perennial borders for continuous bloom; survey of some of the genera contributing importantly to our flower gardens. Of value to non-floriculture students interested in the home grounds. Prerequisite: Botany 100. 3 hours. Offered in 1972-1973 and in alternate years. SAUPE.
231. **Floral Decorations.** Principles of design as applied to the composition and decorative use of flowers, foliage, and accessories. Prerequisite: Junior standing. 3 hours. CULBERT.
232. **Advanced Floral Decorations and Flower Shop Management.** Continuation of Horti-

culture 231. Flower shop management. Prerequisite: Horticulture 231. 3 hours. Offered in 1972-1973 and in alternate years. CULBERT.

233. **Floriculture for the Home.** The fundamentals of home gardening, and the effective use of ornamentals as a part of the home environment. Subject matter includes the selection, culture, and use of garden annuals, biennials, perennials, bulbs, and house plants; garden tools and equipment; soil preparation; plant propagation; principles of design and planting methods; garden maintenance; use of fertilizers; pest control; training and pruning; lawn care; hybridizing; growing structures; and care of cut flowers. Lectures and laboratory. Not open to students in the ornamental horticulture curriculum. 3 hours. FOSLER.
234. **Nursery Management.** A study of the various practices and methods of operating a commercial nursery for the production of ornamental woody plants used for landscaping. Lectures, assigned reading, and laboratory exercises. Prerequisite: Botany 100. 3 hours. Offered in 1973-1974 and in alternate years. MEYER.
236. **Turf Management.** The principles and practices used in the management of the turf grasses in the areas of general and special use. Of value to students interested in one or more aspects of turf grass utilization. Lectures, assigned readings, and laboratory exercises. Prerequisite: Botany 100. 3 hours. TURGEON.
242. **Vegetable Crops Production.** An introduction to the growth habits, soil and climatic requirements, culture, storage, varietal characteristics, and pests of vegetable crops. Prerequisite: Horticulture 100 or consent of instructor. 3 hours. Offered in 1973-1974 and in alternate year. ARNOLD.
251. **Arboriculture.** The principles in the care and maintenance of ornamental trees and shrubs in the established landscape. Consideration is given to environmental factors, soils, nutrition, pruning, tree surgery, insect and disease control. Prerequisite: Agronomy 101. 3 hours. Offered in 1972-1973 and in alternate years. GARTNER.
262. **Fruit Science, I.** Technological application of biological principles to the culture of temperate fruit plants. Prerequisite: Botany 100. 3 hours. Offered in 1972-1973 and in alternate years. DAYTON, ZYCH.
300. **Special Problems.** Supervised research on individual problems in any phase of horticulture, including anatomy, breeding, physiology, ecology, or general culture of fruit, vegetable, or ornamental plants. Prerequisite: Not open to students on probation. Written consent of the instructor and authorized departmental approval is required prior to advanced enrollment and registration. 1 to 5 hours, or 1/2 to 2 units.
307. **International Food Crops.** Same as Plant Pathology 307. Various international food crops are studied with emphasis on production and problems created by diseases and insects. Tropical and subtropical crops are stressed, but temperate food crops of international importance are included. Ecological factors affecting fundamentals of food crop production and plant protection are emphasized. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years. RHODES, SINCLAIR.
321. **Floricultural Physiology.** A study of the physiology and metabolism of floricultural crops during their development from seeds through flowering. Lectures and discussion. Prerequisite: Botany 330 and 335 or equivalent, and one semester of organic chemistry. 4 hours or 1 unit. SPOMER.
322. **Plant Nutrition.** A study of the mechanisms of and factors affecting the absorption, transport, and functions of the essential elements required by higher plants. Lectures, discussions, and laboratory. Prerequisite: Agronomy 101; Botany 234 or 330, or consent of instructor. 4 hours or 1 unit. HUGHES.
323. **Principles of Plant Breeding.** Same as Agronomy 323. Genetic and cytological variation in crop plants, the production and control of such variation in developing varieties and hybrids, and the maintenance of high quality seed stocks. Field trips; estimated cost, \$5.00. Prerequisite: Agronomy 110 or equivalent; Botany 100. 4 hours or 1 unit. LAMBERT, MILLER.
333. **Plant Physiology Laboratory.** A laboratory course in plant physiology. A supplement

to Botany 330; serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or registration in Botany 330 or equivalent. 2 hours or 1/2 unit. DICKINSON, NANCE.

335. **Economics of Food Distribution.** Same as Agricultural Economics 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; (c) consumer demand for food. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or 3/4 or 1 unit. KELLY.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or 3/4 unit. SEIF.
345. **Growth and Development of Horticultural Crops.** Factors affecting growth, development, and quality of horticultural crops, such as photoperiodism, growth regulators, CO₂ levels, etc. Lecture and discussion. Prerequisite: One year of general chemistry and one semester of general or plant physiology, or consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Entomology and Zoology 361. A study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or 1/2 unit. JAYCOX.
424. **Mineral Nutrition of Plants.** Same as Agronomy and Botany 424. A study of the uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in the light of metabolic activity and constituency in functional plant compounds. Major emphasis is placed on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit. HAGEMAN.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Horticulture 340 or equivalent. 3/4 unit.
447. **Horticulture Seminar.** Discussion of current research and literature pertaining to problems of horticulture and related fields. 1/4 unit.
490. **Research Methods in Horticulture.** Lectures, discussions, demonstrations, and laboratory exercises dealing with methods and apparatus used in horticultural research. Prerequisite: Chemistry 131 or equivalent; Chemistry 122 or equivalent; Botany 330; five hours of physics. 1 unit. SPLITTSTOESSER.
492. **Special Topics in Horticulture.** Readings and discussion in selected phases of horticulture including such topics as genetics, physiology, anatomy, morphology, and ecology of horticultural crops. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. 1/2 to 2 units.
499. **Thesis Research.** Research on the thesis problem in floriculture, fruit breeding, pomology, and vegetable crops. Required in horticulture major. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. 0 to 4 units.

HUMANITIES

The Division of Humanities is composed of the Departments of Classics; English; French; Germanic Languages and Literatures; History; Philosophy; Slavic Languages and Literatures; Spanish, Italian, and Portuguese; and Speech; the Graduate Program in Comparative Literature; and the Program in Religious Studies. It sponsors several courses of interdepartmental interest and purpose, serving the requirements of the College of Liberal Arts and Sciences in general education. Its teaching faculty consists of the full-time faculties of the departments listed, of the rank of instructor and above.

The division also sponsors the programs in medieval civilization and in American civilization.

114. **Russian Civilization.** Same as Russian 114. A survey of Russian civilization and culture with special emphasis on areas other than literature: the people, national and social institutions, and religion, and the arts (architecture, sculpture, painting, music, theatre, ballet). No knowledge of Russian required. 4 hours.
151. **The Humanities in Western Culture.** A comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought. History and the novel: for example, Well's *Outline of History*, Thucydides, Third and Fourth Kings (Knox version), *The Odyssey*, *Don Quixote*, *The History of Tom Jones*. Prerequisite: Sophomore standing, James Scholar freshman, or freshman standing with exemption from Rhetoric 101. 4 hours.
152. **The Humanities in Western Culture.** A comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought. Drama, philosophic essay, poetry: for example, Sophocles, Shakespeare, Plato, Nietzsche, St. Augustine, Ecclesiastes, New Testament, Whitman. Prerequisite: Humanities 151. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Ancient Israel: History and Literature.** Same as Religious Studies 201. The major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion. The function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours.
202. **Earliest Christianity: The New Testament Period.** Same as Religious Studies 202. The ministry and teaching of Jesus within the historical context of ancient Judaism, and the development of the Christian church from its beginnings as a sect within ancient Judaism to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours.
203. **The Pentateuch.** Same as Religious Studies 203. Detailed study of the Pentateuch in English: Near Eastern background, literary forms and functions, heritage to Judaism and Christianity. Prerequisite: Humanities 201. 3 hours.
210. **German Literature Since 1648 in English Translation.** Same as German 201. The important trends in German literature since 1648. Reading of some important prose works. For students with no knowledge of German. 3 hours.
211. **The Growth of American Culture.** The social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
212. **The Growth of American Culture.** The social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
215. **Literature and Other Arts, I.** Literature and other arts are considered in the context of a particular historical period and in relationship to the movement of ideas within that period. Prerequisite: Junior standing or consent of instructor. 3 hours.
216. **Literature and Other Arts, II.** Continuation of Humanities 215. Prerequisite: Humanities 215. 3 hours.

255. **Introduction to French Literature in Translation, I.** Same as French 255. A study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures are in English. Not open to students majoring in French. 4 hours.
256. **Introduction to French Literature in Translation, II.** Same as French 256. A study of selected major works of French literature from the Romantic period to the present. Texts and lectures are in English. Not open to students majoring in French. 4 hours.
315. **Nineteenth-Century Literature in Translation.** Same as Russian 315. A study of major Russian writers from Pushkin through Chekhov. No knowledge of Russian is required. 3 hours or 1 unit.
317. **Twentieth-Century Literature in Translation.** Same as Russian 317. A study of major Russian writers from 1900 to the present. No knowledge of Russian is required. 3 hours or 1 unit.
319. **Russian and East European Cinema.** Same as Communications, Slavic, and Speech 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required except for Department of Slavic Languages and Literatures majors. 3 hours or 3/4 unit.
361. **Ibsen.** Same as Scandinavian 361. The dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit. Offered in 1973-1974 and in alternate years.
362. **Strindberg and the Later Scandinavian Dramatists.** Same as Scandinavian 362. Major dramas and prose works of August Strindberg in translation; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Par Lagerkvist. 3 hours or 1 unit. Offered in 1972-1973 and in alternate years.
363. **Introduction to Comparative Literature, I.** Same as Comparative Literature 363. A one year course in two parts, offering a survey of methods and goals of comparative literature, illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or 3/4 unit.
364. **Introduction to Comparative Literature, II.** Same as Comparative Literature 364. Continuation of Humanities 363. 3 hours or 3/4 unit.

Indonesian

(See Asian Studies)

Industrial Engineering

(See Mechanical and Industrial Engineering)

Italian

(See Spanish, Italian, and Portuguese)

Japanese

(See Asian Studies)

JOURNALISM

Head of Department: Professor J. W. JENSEN

Department Office: 119 Gregory Hall

114. **Agricultural Journalism.** Same as Agriculture 114. Writing farm and home news and information material for use in weekly and daily newspapers, principles of news photography and use of other types of illustrations; how to use related forms of writing, visual aids, radio, and television as effective tools of communication. Prerequisite: Sophomore standing recommended. 3 hours.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
204. **Typography.** Study of type lore and design; type dimensions; printer's arithmetic and copyfitting; platemaking; printing processes; shop organization; terminology. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
211. **Newswriting.** Fundamentals of journalistic writing. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
212. **Public Affairs Reporting.** News of public affairs. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 3 hours.
214. **Advanced Agricultural Journalism.** Same as Agriculture 214. Techniques and practice in planning and producing farm and home radio and television programs; editing of popular style leaflets and bulletins based on technical materials; special projects in visual aids, photography, or feature writing; planning informational campaigns using all types of media. Prerequisite: Journalism 114 or consent of instructor. 3 hours.
215. **Contemporary Affairs.** Major news developments and their background; current political, economic, social, and scientific developments. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 2 hours.
217. **History of Communications.** Same as Communications 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; communications and the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
218. **Communications and Public Opinion.** Same as Communications 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
220. **Processes and Systems of Communications.** Same as Communications 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
223. **Photojournalism.** A basic photography course designed to give the student a proficiency in picture taking and processing and to acquaint him with picture editing and other illustrative problems. Cost of materials approximately \$15.00 per student. Cameras are provided by the college. Prerequisite: Registration in the College of Communications; consent of instructor. 3 hours.
231. **Mass Communication in a Democratic Society.** Same as Communications 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
233. **Publication Design and Production.** Theory of publication design; techniques of graphic production; relationship of design and graphics to the realities of commercial printing. Prerequisite: Journalism 204 or consent of instructor. 2 hours.
241. **Law and Communications.** Same as Communications 241. The historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in journalism for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours.
308. **High School Journalism.** Journalistic writing in the high school; newspaper study and training of newspaper readers; supervision of school publications and publicity; junior college courses in journalism. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.

- 310. Typographic Disciplines of the Book.** Same as English 392 and Library Science 310. The study of the book as a manufactured object, with emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration. Extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.
- 321. News Editing.** Newspaper desk work; editing the news; correction of faulty news stories; handling wire copy. Attention to headwriting, news pictures, and makeup and design of newspaper pages. Prerequisite: Credit or registration in Journalism 204 and 212; registration in the College of Communications or consent of the college. 4 hours or 1 unit.
- 323. Advanced Reporting.** Advanced types of news investigations and treatment. Prerequisite: Journalism 211 and 212; registration in the College of Communications or consent of the college. 3 hours or 1/2 unit.
- 326. Magazine Article Writing.** Preparation of feature stories and articles; techniques of marketing, market analysis, and publishing articles written in the course. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 3 hours or 1/2 unit.
- 327. Special Topics in Twentieth-Century Journalism.** Special topics, particularly on recent developments in such areas as radio, advertising, television, and modern magazines. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 2 hours or 1/2 unit.
- 329. The Rhetoric of Journalism.** Studies in journalistic method, involving principally the analysis of structure and writing style as related to purpose. Materials are drawn from English and American journalism from the seventeenth century to the present, but emphasis is on work published in twentieth-century American newspapers and periodicals. Prerequisite: Journalism 211 or consent of instructor. 2 hours or 1/2 unit.
- 330. Magazine Editing.** Basic principles of editing for consumer, business, trade, and company magazines; communications theory, market analysis, editorial process, design process, production process, and distribution process as they relate to magazine publishing. Prerequisite: Credit or registration in Journalism 326. 3 hours or 1/2 unit.
- 468. The Political Economy of Communications.** Same as Communications 468. Analysis of the structure, policy, and behavior of such media of communication as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film, with special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
- 470. Communications and Popular Culture.** Same as Communications 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
- 471. Proseminar in Communications, I.** Same as Communications 471. A general discussion of the mass media of communications, their role as social institutions, their control, and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
- 472. Proseminar in Communications, II.** Same as Communications 472. A general discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
- 473. History and Theory of Freedom of the Press.** Same as Communications 473. Development of the Anglo-American press system and the idea of freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
- 474. Communications Systems.** Same as Communications 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. Prerequisite: Consent of College of Communications. 1 unit.
- 490. Special Topics in Journalism.** Prerequisite: Consent of head of department. 1/2 or 1 unit.

492. **Research Methods in Communications.** Same as Communications 492. An introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication, with emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in journalism. 1 to 2 units.

Korean

(See Asian Studies)

LABOR AND INDUSTRIAL RELATIONS

Director of Institute of Labor and Industrial Relations: Professor M. ROTHBAUM
Institute Office: 247 Labor and Industrial Relations Building

199. **Undergraduate Open Seminar.** 0 to 9 hours.
315. **The Economics of Poverty and Income Maintenance.** Same as Economics 315. An economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
318. **Industry and Society.** Same as Sociology 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; the changing bases of managerial authority. Prerequisite: Sociology 100, or six hours of social science, or consent of instructor; junior standing. 3 hours, or 1/2 or 1 unit.
321. **Industrial Social Systems, I.** Same as Business Administration 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environments; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210; Psychology 100; Psychology 201 or consent of instructor. 3 hours, or 1/2 to 1 unit.
341. **The Economics of Labor Markets.** Same as Economics 341. A study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems. Topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
343. **Unions, Bargaining, and Public Policy.** Same as Economics 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States. Includes theory of the labor movement; processes of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
345. **Economics of Manpower.** Same as Economics 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; private industry and union manpower planning. Graduate credit is not given for both Labor and Industrial Relations or Economics 345 and 444. Prerequisite: Economics 103 or 108. 3 hours, or 1/2 or 1 unit.
347. **Labor Law, I.** Same as Law 347. The law of industrial relations with special emphasis

- on recent cases and legislation; the establishment of the collective bargaining relationships, strikes, boycotts, and picketing; Federalism and labor relations. 3 hours or 1 unit.
- 355. Industrial Social Psychology.** Same as Psychology 355. Social psychological research and theory applied to industrial problems. Emphasis upon interaction and communication theory, role theory, leadership theory, motivational and perceptual theory and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or 1/2 or 1 unit.
- 357. Psychology of Industrial Conflict.** Same as Psychology 357. An analysis in terms of the behavior of individuals of the causes and possible solutions of industrial conflict. Offered in special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or 1/2 or 1 unit.
- 360. Employee Benefit Plans.** Same as Finance 360. An analysis of the economic and financial issues involved in designing and administering employee benefit plans. Major emphasis is given to group life, disability income, and medical care plans, and to "qualified" pensions and profit-sharing plans for regular employees. Some attention is given to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Industrial Administration 351, or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 418. Seminar in Industrial and Economic Sociology.** Same as Sociology 418. Discussion and individual research on such topics as industrialization, labor-management relations as group relations, the interrelations of industry and community, technology and the structure of controls in industry, and the problem of a social economics. Prerequisite: Labor and Industrial Relations 318 or consent of instructor. 1 unit.
- 420. Formation of Public Policy.** Same as Political Science 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, and judicial activity. 1 unit.
- 435. Motivation and Morale in Industry.** Same as Psychology 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
- 440. Labor Economics.** Same as Economics 440. A survey of recent trends in the labor force, of real and money earnings, and of the distribution of national income. This review of recent trends in these areas is used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.
- 441. Labor Economics.** Same as Economics 441. The economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free enterprise economy). Emphasis in all cases is upon the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
- 442. Collective Bargaining.** Same as Economics 442. The development of a theory of the continuing interactions between union and management which define and modify the role of each and the terms of employment. Appropriate social science concepts are used. Emphasis is on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority as well as on the interactions between the parties and the governmental process. Prerequisite: Consent of instructor. 1 unit.
- 443. Problems and Practices of Labor Dispute Settlement.** Same as Economics 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling; analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit.
- 444. Economics of Manpower Resources.** Same as Economics 444. Emergence of the manpower resource issue; population as a resource base; the labor force; measurement and

characteristics, behavior under changing income, employment, technology; women as the dynamic factor in labor force growth; problems of utilization of labor force components; intellectual resources, older workers, manual, white collar, Negro, marginal forces; issues of national manpower policy. Graduate credit is not given for both Labor and Industrial Relations 444 and 335. Prerequisite: Consent of instructor. 1 unit.

445. **Investment in Human Resources.** Same as Vocational and Technical Education 445. Activities which influence future monetary and psychic income by improving the resources in people. The investments covered include schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes, with main emphasis on education. A last section covers educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.

447. **Labor Union Organization and Administration.** Same as Economics 447. Analysis of the structure, functions, and government of the modern American trade union movement. Provides a survey of the environmental factors, objectives, and action programs with considerable emphasis on economic as well as internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit.

448. **Problems of Personnel Management.** Same as Business Administration 448. An examination of the organization and administration of the personnel function in management. The course deals with the relations of personnel administration to operating departments, and the scope of business and industrial personnel services. Analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, is carried out through case studies and direct industrial contacts. Specific consideration is given to problems up to and including placing the person on a job. Prerequisite: Business Administration 248 or equivalent; consent of instructor. 1 unit.

449. **Problems of Personnel Management.** Same as Business Administration 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. 1 unit. Prerequisite: Business Administration 248 and 448, or equivalent. 1 unit.

450. **Management and Industrial Relations.** An analysis of the industrial relations function in management. Using case problems, research reports, and theoretical analyses, an examination is made of the development of the industrial relations function, alternate organizational approaches in dealing with employees and unions, the formation of labor relations policies, and management responsibilities in industrial relations. Prerequisite: Consent of instructor. 1 unit.

454. **Foreign and International Labor Movements.** History and organization, economic and political policies of the major labor movements in the world; their international organizations; comparative analysis of particular problems confronting these movements; labor movements in underdeveloped areas; labor and economic development; labor under totalitarian regimes. Prerequisite: Consent of instructor. 1 unit.

455. **Labor in Less Developed Countries.** The labor problem in economic development. The development of institutions and systems of industrial relations. Prerequisite: Consent of instructor. 1 unit.

490. **Individual Topics.** A student in labor and industrial relations may register for this unit with the consent of his curriculum adviser and the adviser under whom he will perform the individual study or research. Such individual work may include special study in a subject matter for which no course is available or an individual research project, including on-the-job research in industry, which is not being undertaken for a thesis. 0 to 2 units. STAFF.

491. **Research Workshop.** A seminar in applied group research. A general topic for research is assigned; the class adopts a general strategy or approach to the problem, and individual students select a particular aspect of the problem to investigate. Designed as a sequel

to LIR 492 to give students experience in joint research on practical problems in industrial relations of the type they might expect to work on in business, government, or unions. This seminar or the tutorial is required of all M.A. candidates in the B program sequence. Prerequisite: Labor and Industrial Relations 492. 1 unit.

492. **Research Seminar in Labor and Industrial Relations.** Systematic analysis of theories and procedures of the various social and physical sciences bearing on research in labor and industrial relations. Primary emphasis is on the process of integrating the approaches and techniques of the various social sciences with respect to the study of problems in labor and industrial relations as met in practice in management, the union, and government service, as well as in teaching and research in the field. Prerequisite: Major in social sciences or consent of instructor. 1 unit.
493. **Quantitative Methods in Labor and Industrial Relations.** An introduction to statistical concepts and methods in the social sciences and their application to industrial relations problems. The course familiarizes the student with modern methods of probability sampling, statistical inference, and multivariate analysis, and their application to current research problems in labor and industrial relations. Prerequisite: Any elementary statistics course, such as Economics 170. 1 unit.
494. **The Major Theorists of Industrial Relations.** An integrated analysis of the principles of labor relations through the study of the works of the major theorists and their critics. Prerequisite: Consent of instructor. 1 unit.
495. **Application of Theory to Contemporary Problems in Labor and Industrial Relations.** A seminar for advanced graduate students in the application of social science and industrial relations theory and research methodology to selected contemporary problems. Seminar discussions focus on work developed by the seminar members. Prerequisite: Labor and Industrial Relations 493 and 494, or consent of instructor. 1 unit.
496. **The Evolution of Labor-Management Relations in America.** Analysis and interpretation of the development of labor-management relations at the plant and industry levels from the stages of master and servant and master and journeyman in colonial times to the stage of constitutional government and industrial democracy in the present day. Prerequisite: Graduate standing in labor and industrial relations or consent of instructor. 1 unit.
497. **Collective Bargaining in Public Employment.** Same as Social Work and Educational Administration 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector—federal, state, and local. Analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
498. **Analysis of Organizations in Industrial Relations.** An intensive analysis of organizational behavior, with the main focus upon the theory of organizations as social institutions. Concepts are drawn from the various social sciences and applied to the principal organizations concerned with industrial relations. The internal dynamics of unions, managements, and government agencies are examined, with special reference to decision-making processes, and are related to the interactions among them. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** For all students writing theses in labor and industrial relations. 0 to 4 units.

LANDSCAPE ARCHITECTURE

Head of Department: Professor R. B. RILEY

Department Office: 205 Mumford Hall

101. **Introduction to Landscape Architecture.** A survey of the profession, practice, and philosophy of landscape architecture. 2 hours.

102. **Site Planning.** Principles and procedures of site analysis, land use determination, and landscape development. 2 hours.
122. **Landscape Surveys.** Principles and practices of identifying, analyzing, and recording landscape resources. Field trip required; estimated cost, \$20.00. 3 hours.
133. **Landscape Design.** Basic elements and procedures of landscape design; principles of landscape composition and communication of ideas. 4 hours.
134. **Site Design.** Principles of site planning; orientation, circulation, and land use definitions applied in typical landscape development situations. Prerequisite: Landscape Architecture 133 or consent of instructor. 4 hours.
141. **Landform Design.** An introduction to the basic elements, principles, and methods of grading and surface drainage. 3 hours.
151. **Plant Materials, I.** Identification, ecology, and uses of woody and herbaceous plants; deciduous trees, shrubs, and ground covers; annuals, perennials, and grasses. Field trip required. Prerequisite: Biology 100, Botany 100, or Geography 103, or consent of instructor. 3 hours.
152. **Plant Materials, II.** Identification, ecology, and uses of plant types; woody evergreen trees, shrubs, and ground covers; herbaceous wild flowers, bulbs, and aquatic plants. Field trip required. Prerequisite: Biology 100, Botany 100, or Geography 103, or consent of instructor. 3 hours.
181. **Visual Communications, I.** Principles and techniques of graphic presentation of landscape architecture projects. Prerequisite: Architecture 171 and 172. 2 hours.
182. **Visual Communications, II.** Continuation of Landscape Architecture 181, with emphasis on three-dimensional and other non-graphic means of visual presentation. Prerequisite: Landscape Architecture 181. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Field Trip.** Field trip to urban areas to observe and examine examples of landscape architecture, architecture, and planning; includes visits to private and public professional offices. Fee of approximately \$50.00 required for traveling expenses. Prerequisite: Sophomore or junior standing in landscape architecture or consent of instructor. 0 credit.
213. **People, Land, and Environment.** Non-technical study of the landscape and the environment as products of a natural base worked upon by people, their technologies, and their beliefs. Approach is both historical (from pre-history to science fiction) and problem-oriented (the use of land, resources, and energy). 2 to 4 hours.
214. **History of Landscape Architecture.** Analysis of the development of landscape design as a result of environmental and cultural influences. 3 hours.
226. **Principles of Park Design.** Introduction to the theory of master planning and site design as related to recreation area development, administration, and operations. 2 hours.
235. **Recreation Land Design.** Techniques of analysis, design, and presentation applied in various recreational land development situations. Prerequisite: Landscape Architecture 134 or consent of instructor. 4 hours.
236. **Urban Land Design.** Techniques of analysis, design, and presentation applied in various residential land development situations. Prerequisite: Landscape Architecture 235 or consent of instructor. 4 hours.
243. **Site Engineering.** Principles of design and layout of circulation and utility systems. Prerequisite: Landscape Architecture 102 and 141. 3 hours.
244. **Landscape Construction.** Materials and methods of construction applied in the design of landscape structures. Prerequisite: Landscape Architecture 102 or consent of instructor. 3 hours.
246. **Professional Practice.** Professional responsibilities of the landscape architect; methods of practice; preparation and execution of contracts and specifications. Prerequisite: Senior standing in landscape architecture or consent of instructor. 3 hours.
253. **Planting Design, I.** Applied plant ecology related to the process of landscape planning and design. Prerequisite: Landscape Architecture 151 or 152. 3 hours.

254. **Planting Design, II.** Selection and arrangement of plant materials for aesthetic and functional purposes. Prerequisite: Landscape Architecture 151 or 152. 3 hours.
337. **Regional Landscape Design.** Advanced problems of landscape design for urban and institutional situations. Prerequisite: Landscape Architecture 236 or consent of instructor. 5 hours, or 1 to 1 1/2 units.
338. **Thesis Design Project.** Terminal project; comprehensive landscape architectural development. Prerequisite: Landscape Architecture 337 or consent of instructor. 5 hours, or 1 to 2 units.
435. **Urban Design.** Design development of new or renewed urban areas and systems in collaboration with architecture and urban planning students. Prerequisite: Passage of special design examination; credit or registration in Urban Planning 384. 2 units.
436. **Advanced Landscape Design.** Comprehensive master planning and site design for large public, semipublic, and private properties. Special problems in collaboration with students from other disciplines are encouraged. Prerequisite: Passage of special design examination or consent of instructor. 1 unit.
437. **Regional Landscape Design.** Detailed investigation of landscape resources and characteristics of large geographical areas; determination of land use design proposals. Prerequisite: Consent of instructor. 1 unit.
457. **Landscape Management.** Investigation of management theories, policies, and practices which influence landscape preservation and development, with emphasis on their cumulative effects upon natural processes and aesthetic qualities. Prerequisite: Consent of instructor. 1 unit.
467. **Landscape Architecture Professional Education.** Investigation and analysis of philosophies, concepts, structures, and techniques of professional landscape architecture educational programs. 1 unit.
477. **Development of Landscape Architectural Thought.** Exploratory study of times, traditions, and philosophies which have shaped past and present attitudes toward landscape development; application to contemporary issues. Prerequisite: Consent of instructor. 1/2 unit.
487. **Seminar.** Preparation, presentation, and discussion of research papers on current and future areas of landscape architectural application. Prerequisite: Consent of instructor. 1/2 unit.
490. **Special Problems.** Nature and scope of projects determined in consultation between student and faculty adviser. Open to landscape architecture majors as well as those from other disciplines who wish to engage in interdisciplinary work. Prerequisite: Consent of instructor. 1/2 to 1 unit.
499. **Thesis Research.** 0 to 1 1/2 units.

Latin

(See Classics)

LATIN-AMERICAN STUDIES

Director of Center for Latin-American Studies: Professor M. H. FORSTER
Center Office: 1208 West California Avenue, Urbana

This program is sponsored by the Center for Latin-American Studies. The program is described in the Undergraduate Study catalog under the interdepartmental majors of the College of Liberal Arts and Sciences.

195. **Freshman Seminar.** An intensive review of domestic and foreign factors influencing violence and social change in Latin America. Each semester a particular topic is select-

ed. Prerequisite: Freshman James Scholar or other designation as a superior student. 3 hours.

201. **Conflict in Latin America.** A topical survey of social, economic, and political factors influencing conflict and violence in Latin-American life. Each semester a particular topic is considered. Prerequisite: A basic course in a social science discipline. 3 hours.

LAW

Note: Information on professional courses which may be taken for credit by LL.M., M.C.L., and J.S.D. candidates may be obtained from the College of Law catalog, available at the office of the Dean of the College of Law, 209 Law Building.

400. **Seminar: Legal Education.** Problems in legal education, curricula, teaching materials, methods of teaching, the place and function of individual courses in the law school program. 1/2 unit.
499. **Thesis Research.** 0 to 3 units.

LIBERAL ARTS AND SCIENCES

Program Administrator: Professor R. K. APPLEBEE

Office: 294 Lincoln Hall

140. **Thought and Structure in Physical Science.** An approach to the structure of scientific theories, using some of the subject matter of descriptive anatomy and physics. Emphasis is placed on the nature of scientific thinking and the criteria for the validity of scientific ideas. Lecture, laboratory, and discussion. 4 hours.
141. **The Physical Universe.** A study of the various forms of universal energy, using some of the subject matter of cosmology and modern physics. Emphasis is placed on such items as man's ability to measure very far distances and to interpret the evidence for the origin of the solar system and of the universe. 4 hours.
142. **Earth Evolution and Chemical Environments.** Same as Geology 142. A physical science course for non-science majors, presenting a general discussion of the origin and evolution of the earth, its continents and ocean basins, and basic chemical aspects of the earth's ecologic systems, including water and air pollution, radiation chemistry, and the use of pesticides in nature. 4 hours.
143. **Environmental Physical Science.** Same as Geology 143. A physical science course for non-science majors with emphasis on earth processes and resources relevant to modern society. The course attempts to place in perspective the physical limitations imposed by earth, by discussing the physical nature of the environment and the basic principles that apply within pollutant levels, and conditions for a stable environment. 4 hours.
197. **Freshman Seminar in Physical Science.** Formerly Division of General Studies 197. A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Galileo to Faraday have supported new scientific concepts and theories. Discussion, individual research, and reports; laboratory work replicating significant experiments. Prerequisite: James Scholar or designation as superior student; consent of instructor. 4 hours. ROSEN.
198. **Freshman Seminar in Physical Science.** Formerly Division of General Studies 198. A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Maxwell to modern times have supported new scientific concepts and theories. Discussion, individual research, and reports; laboratory work replicating significant experiments. Prerequisite: Liberal Arts and Sciences 198. 4 hours. ROSEN.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
299. **L.A.S. Study Abroad.** Provides campus credit for foreign study and/or travel. A student's proposal for study abroad must have prior approval of the major department and the College of Liberal Arts and Sciences office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Permission of the student's major department and the College of Liberal Arts and Sciences office. 0 to 15 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 30 semester hours per academic year or to a total of 36 semester hours, all of which must be earned within one calendar year.

LIBRARY SCIENCE

Director of Graduate School of Library Science: Professor H. GOLDHOR
School Office: 329 Library

195. **Introduction to Library Use.** Use of the card catalog, periodical indexes, encyclopedias, dictionaries, and other reference books. Intended for freshman and sophomores; not to be counted toward the undergraduate minor in library science. Not for students in the Graduate School of Library Science. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Reference Service:** A basic course on the most commonly used reference sources, stressing the study of the various types of reference tools, e.g., dictionaries, encyclopedias, printed indexes, biographical dictionaries, yearbooks, directories, and handbooks. Methods of studying such materials and matters of bibliographical form also are emphasized, in order to lay a foundation for succeeding courses in the field. Prerequisite: Sixty hours of academic work. 3 hours.
204. **Development and Operation of Libraries.** Seeks to introduce the student to the development of the library as an institution, the concept of a philosophy of librarianship, and the general operation of libraries. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours).
255. **Organization of Library Materials.** Designed to provide an introduction to the function and form of the modern library catalog and to present-day practices in the cataloging and classification of books and audio-visual materials, as practices in modern libraries. Prerequisite: Junior standing (sixty hours of academic work). 3 hours.
258. **Selection of Library Materials.** The philosophy and practice of building the library collection. Attempts to develop familiarity with book trade channels, especially those in the United States, and to acquaint students with the aids useful in selecting and acquiring books, periodicals, documents, and other print and nonprint materials. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours).
301. **Literature of the Humanities and Social Sciences.** This course is designed to build a knowledge of the scope and significant characteristics of the several fields comprising the humanities and social sciences through a systematic study of names, trends, and outstanding classic and current materials in each. Attempts to identify general basic knowledge for each field which is essential for the librarian in selection of materials and reading guidance. Prerequisite: Senior standing. 3 hours or 1 unit.
302. **Literature of the Sciences.** An introduction to the scope and significant characteristics of the literature of science, to modern concepts and representative literary works in each of the major fields of pure and applied science. Designed to give an insight into the content of the scientific disciplines and of their role in modern society. Selected readings and films acquaint students with representative material in the field. Prerequisite: Senior standing, and Library Science 204 and 258, or consent of instructor. 3 hours or 1 unit.

303. **Library Materials for Children.** The selection and use of library materials for children in public and school libraries, according to the needs of the child in his physical, mental, social, and emotional development and the purposes of the elementary school program. The student becomes acquainted with the standard selection aids for children and with all types of printed and audio-visual materials and develops the ability to select and describe children's library materials according to their developmental uses. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
304. **Library Materials for Young Adults.** The selection and use of library materials for the young adults in school and public libraries and community organizations. The course aims to develop the ability to select and evaluate a wide variety of reading materials from standard bibliographies for the young adult according to his personal and school needs. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
308. **Audio-visual Services in Libraries.** Designed to acquaint student with the typical audio-visual programs and responsibilities of libraries. Group activities stress, through presentation and evaluation, the use of materials and related equipment necessary for film, radio and television, exhibit, and other programs of libraries. The practices of audio-visual departments in libraries are reviewed and evaluated. Prerequisite: Junior standing. 3 hours or 1 unit.
309. **Storytelling.** Fundamental principles of the art of storytelling including techniques of adaptation and presentation. Content and sources of materials; story cycles; methods of learning; practice in storytelling; planning the story hour for the school and public libraries, for recreational centers, for the radio, and for television. Open to undergraduates and non-Graduate School of Library Science students. Prerequisite: Library Science 303 or consent of instructor. 3 hours, or 1/2 or 1 unit.
310. **Typographic Disciplines of the Book.** Same as English 392 and Journalism 310. The study of the book as a manufactured object, with emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration. Extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.
354. **Audio-Visual Communication.** Same as Elementary Education and Secondary and Continuing Education 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or 1/2 or 1 unit.
402. **Studies in Reading.** Designed to acquaint students with the major areas of investigation and interest in reading. Special attention is given to studies of reading interests and habits of children, youth, and adults. Class discussions are devoted to analysis of various studies and their implications for library service and classroom teaching. 1 unit.
405. **Library Administration.** Designed to supply knowledge of the internal organization of libraries and of the principles of library administration. Emphasis is on comparison of the conditions found in the several kinds of libraries and on applications of the general theory of administration. Prerequisite: Library Science 204 or consent of instructor. 1 unit.
406. **Library Service to Children and Young Adults.** The role, problems, and needs of library service in the elementary and secondary school fields, and of library work with children and young adults in the public library. A two-day field trip is required; estimated cost, \$25.00. Credit is not given for Library Science 406 in addition to credit in Library Science 307. Prerequisite: Library Science 204 or 405. 1 unit.
407. **Cataloging and Classification, I.** The theory, practice, and application of the principles of cataloging and classification. Emphasizes subject cataloging and complex types of entry. Problems provide experience with the Decimal Classification and Library of Congress Classification and Library of Congress subject headings. Prerequisite: Library Science 255 or consent of instructor. 1 unit.
408. **Cataloging and Classification, II.** The theory, practice, and application of the principles

of cataloging and classification. Takes up the cataloging and classification of special types of materials, including maps, music, films, slides, phonograph records, and incunabula and other rare items. Includes some discussion of the administrative problems of a cataloging department. Prerequisite: Library Science 407. 1 unit.

409. **Communication Roles and Responsibilities of Libraries.** Mass media of communication are considered in terms of their relations with modern library services; media organization, content, and research are reviewed; problems of intellectual freedom are considered as an aspect of communications behavior; and the potential role of electronic devices in library activities now and for the future is discussed. 1 unit.
410. **Adult Education and Libraries.** The literature, history, and problems of adult education in the United States are presented in relation to the role of the library as an educational agency. Students study organization for adult education in the community and become familiar with the significant methods and materials used in a variety of educational programs. 1 unit.
411. **Reference Service in the Humanities and Social Sciences.** Detailed consideration of the bibliographical and reference materials in various subject fields, with training and practice in their use for solving questions arising in reference service. Prerequisite: Library Science 201 or consent of instructor. 1 unit.
412. **Science Reference Service.** Study of representative reference sources in pure and applied science. Designed to acquaint the student with typical problems encountered in providing and servicing scientific reference materials. Prerequisite: Library Science 201 or consent of instructor. 1 unit.
415. **Library Automation.** Introduces various types of equipment for handling information and providing services in libraries; studies applications to library operations; includes introduction to systems planning, to automation concepts, and to computer use. Prerequisite: Library Science 201, 204, 255, and 258, or consent of instructor. 1 unit.
424. **Government Publications.** The nature and scope of American and British government publications; the problems of organization arising from their form and from the methods of their production and distribution. Prerequisite: Library Science 411 or 412, or consent of instructor. 1 unit.
427. **Resources of American Research Libraries.** Aims to acquaint students with the distribution and extent of American library resources for advanced study and research; spatial and financial aspects of library resources; methods of surveying library facilities; growth and use of union catalogs and bibliographical centers; interinstitutional agreements for specialization of collections and other forms of library cooperation; and the use by the scientist and scholar of the research collection. 1 unit.
428. **Library Buildings.** A study of the library's physical plant in the light of changing concepts and patterns of library service. Present-day library buildings, both new and remodeled, are analyzed and compared with each other as well as with buildings of the past. The interrelationship of staff, collections, users, and physical plant is examined in detail. Class discussion is supplemented by visits to new libraries and conference with their staffs. A two-day field trip is required; estimated cost, \$25.00. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
429. **Information Storage and Retrieval.** Analyzes the problems which confront libraries and library users as a result of the growth of literature; reviews the various systems for storing and retrieving information; introduces the underlying models and basic types of equipment for both traditional and non-conventional systems; emphasizes practical applications in libraries and information centers. Prerequisite: Consent of instructor. 1 unit.
430. **Advanced Reference.** Designed to enable the student to utilize the varied resources of a large research library. Deals with the methods of analyzing and solving bibliographic problems such as arise in scholarly libraries and in connection with research projects. Prerequisite: Library Science 424 or consent of instructor. 1 unit.
431. **Books and Libraries in the Ancient and Medieval World.** The development of writing and of the book in ancient and medieval times; book collecting and the growth of libraries from earliest times to the discovery of printing. 1 unit.

432. **Books and Libraries Since the Renaissance.** Same as Communications 432. The study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
433. **Advanced Subject Bibliography.** A study of the literature, information sources, and reference aids in various specialized fields of knowledge, identified as different sections of this course, from the point of view of their use by librarians. No student may take more than two different sections for credit toward a degree: (b) biological sciences, (c) chemistry, (d) education and psychology, (e) engineering, (g) law, (h) maps, (i) music, (j) Slavic bibliography. 1/2 unit. Prerequisite: Consent of instructor.
434. **Library Systems.** Considers the development of library systems, with special reference to public libraries as a norm for the development of library services: library standards, the growth and development of county and regional libraries, the role of the state library and of federal legislation are among the topics treated in detail. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
438. **Administration and Use of Archival Materials.** Administration of archives and historical manuscripts, with emphasis on the processing and research use of archival materials. Prerequisite: Consent of instructor. 1 unit.
439. **Medical Literature and Reference Work.** Considers representative reference and bibliographical aids in medical sciences. Problems provide experience with typical medical reference sources (only at the University of Illinois Medical Center in Chicago). 1 unit. Prerequisite: Consent of instructor. Offered in the summer session only.
440. **Problems in Bibliographical Method.** Same as English 450. Work on individual bibliographical problems, with a study of bookmaking, manuscripts and their relation to the printed text, editorial problems, and literary forgeries. Prerequisite: Consent of instructor. 1 unit.
441. **History of Children's Literature.** Interpretation of children's literature from the earliest times to the present, with recognition given to the impact of the changing social and cultural patterns on books for children and on children's reading. Attention is given to the early printers and publishers of children's books and to magazines for children in the nineteenth century. 1 unit.
442. **Seminar in Library Materials for Children and Young Adults.** Advanced study of the criteria for the evaluation of books, films, and recordings. Each student completes a project on a given theme or subject, involving extensive and critical reading, viewing, and listening. Prerequisite: Library Science 303 or 304, and Educational Psychology 211, or consent of instructor. 1 unit.
443. **Contemporary Book Publishing.** Survey of twentieth-century book publishing, particularly in America, placing it in an economic, social, and literary context. Emphasis is on production, technological developments, economic structure, methods of distribution and promotion, and book publishing as an art. 1 unit.
444. **Evaluation of Information Services.** Methods for evaluating information retrieval systems, including dissemination systems and printed indexes. Methodology of evaluation and factors affecting performance of systems. Prerequisite: Library Science 429 or consent of instructor. 1 unit.
450. **Advanced Studies in Librarianship.** Directed and supervised investigation of selected problems in library resources, reference service, research libraries, reading, public libraries, or school libraries. 1/2 to 2 units. Prerequisite: Fifth-year degree in library science or consent of director.
460. **Special Topics in Librarianship.** An advanced seminar on topics of individual choice; presentation and criticism of written research reports based on individual study on an advanced level. Students may enroll in a maximum of two sections, concurrently or consecutively. Open to doctoral students only. Prerequisite: Consent of instructor. 1/2 to 2 units.
465. **Librarianship and Society.** Analysis of the role and functions of libraries in the twentieth century; the changing characteristics of information and knowledge are viewed as major

determinants of libraries' relations to society. Prerequisite: Master of Science in Library Science or consent of instructor. 1 unit.

- 468. Teaching Methods and Special Problems in Contemporary Library Schools.** Designed for those interested in preparing for the teaching of library science at the graduate level. Current library school programs and the various methods of instruction are analyzed as to effectiveness and application for the major areas of library science content; attention is given to the process of curriculum construction to meet the changing needs of the profession and to the experience of other professions. Prerequisite: Library Science 462 or consent of instructor. 1 unit.
- 469. Principles of Research Methods.** Designed for persons planning to engage in research. The course reviews significant investigations in the library field, and considers the use of hypotheses, the conduct of experiments, the nature of proof, and the employment of statistical methods, with a view to helping students develop their dissertations. Required for Ph.D. candidates. Prerequisite: Knowledge of the principles of statistics. Master of Science in Library Science, or consent of instructor. 1 unit.
- 499. Thesis Research.** Individual study and research. Section A: M.S. candidates, 0 to 2 units. Section B: doctoral candidates, 0 to 4 units.

LIFE SCIENCES

(Including Biology, Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology)

Director of School of Life Sciences: Professor L. L. CAMPBELL

School Office: 387 Morrill Hall

The School of Life Sciences is an association of the five biology departments in the College of Liberal Arts and Sciences (Departments of Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology), plus the Electron Microscope Facility and the Natural History Museum. Courses taught on a cooperative basis within the School are designated as biology courses and are listed below following the section on biology major programs. Courses offered by individual departments are listed under the appropriate departmental headings.

INTRODUCTORY SEQUENCES IN BIOLOGY

Several different introductory sequences, appropriate for different purposes, are listed below.

1. Biology 100, 101. A general education sequence.
2. Botany 100 or 101. Entomology 103, 118, Microbiology 113, Physiology 103 or 203, Zoology 104, 105 (any two). Courses for general education sequences.
3. Biology 110, 111. The preprofessional sequence required in the general biology major and in all School of Life Sciences departmental major programs.
4. Biology 151, 251. A preprofessional sequence restricted to and required of the honors biology major.

Four hours of proficiency credit in Biology 100 may be used toward sequence (1) or (2) above; recommended placement is in Biology 101. Unless otherwise specified in course descriptions, sequence (3) or (4) is recommended for admission to 200- and 300-level courses in biology. However, students who complete a general education course or sequence and then decide to major in biological sciences may do so with the concurrence of their adviser without enrolling in a second introductory sequence.

JUNIOR-SENIOR HONORS PROGRAM AND DISTINCTION

Students maintaining a "B" average in any of the departmental or interdepartmental biology programs are eligible for junior-senior honors programs. The honors seminar (Biology 203) and supervised research projects are recommended for these students. The amount of credit in such programs which may be applied to the major and for graduation varies for different majors; information is available from advisers and departmental offices. Satisfactory comple-

tion of such programs is recognized by a diploma citation showing departmental distinction. Students who wish to be candidates for distinction should notify the biology honors committee or the appropriate departmental committee early in their last semester.

BIOLOGY MAJOR PROGRAMS

In addition to several specialized curricula listed in the Undergraduate Study catalog and departmental major programs outlined under the departmental headings below, the School of Life Sciences provides two programs leading to a major in biology.

Honors Major in Biology: This program is designed for superior students and provides a broad foundation in biological and physical sciences suitable as a basis for graduate and professional training in biology. Entry requires permission of the Honors Biology Committee, advanced standing in biology, James Scholar status or other evidence of superior background and achievement. Continuation requires a minimum grade of "B" in each of the core biology courses, Biology 151, 251, 351. In addition to general college requirements, students in the program must:

1. Complete a major consisting of Biology 151, 251, 351, and ten hours in courses offered by departments of the School of Life Sciences and numbered 300 or above. Two of the ten-hour requirement may be in departmental special topics courses (Botany 300, Entomology 306, Microbiology 207, Physiology 290, Zoology 303).

2. Complete a minor in chemistry consisting of Chemistry 107, 108, 136, 181; Biochemistry 350, and 355. Students whose placement examination scores prevent their taking Chemistry 107, 108 may substitute Chemistry 101, 102.

3. Complete Mathematics through 140 or 141 or 145.

4. Complete Physics 101 and 102, or 106, 107, and 108.

Students entering this curriculum are cautioned to arrange their freshman and sophomore programs so they can meet the college requirements of thirty hours of advanced courses in the junior and senior years.

General Major in Biology: This program is suitable for either terminal or preprofessional objectives for which broad biological training is desired. Students must complete a major consisting of Biology 110, 111, and an additional twenty hours of courses at the 200 and 300 level offered within the School of Life Sciences, chosen in consultation with the adviser, and including at least one of the following—Biology 210, Microbiology 200 and 201, or Physiology 301 and 303. Up to five hours of the twenty-hour requirement may be in departmental special topics courses (Botany 300, Entomology 306, Microbiology 207, Physiology 290, Zoology 303). Students are also required to complete a year of physics, chemistry through organic with laboratory, and mathematics through Mathematics 120. Additional calculus and biochemistry are strongly recommended.

Biology

Office: 393 Morrill Hall

100. **Biological Science.** Introduction to the biological sciences, their aims, content, and methods, with special reference to their application to human life and civilization. 4 hours.
101. **Biological Science.** Continuation of Biology 100. Prerequisite: Biology 100 or consent of instructor. 4 hours.
110. **Principles of Biology, I.** Heredity, evolution, diversity, reproduction, development, structure and function of cells, organisms, and populations. Prerequisite: One year of college chemistry or enrollment in chemistry. 5 hours.
111. **Principles of Biology, II.** Continuation of Biology 110. Prerequisite: Biology 110. 5 hours.
115. **Heredity, Evolution, and Society.** Basic principles of heredity and evolution with emphasis on the significance to human society. Credit is not given for Biology 115 and

- Biology 210 and Zoology 106 or 107. Prerequisite: Four hours credit in a biological science. 4 hours.
151. **The Cell.** Study of the biology of cells from the molecular to the microscopic levels of organization. Prerequisite: Credit or registration in organic chemistry; consent of Honors Biology Committee. 5 hours.
 198. **Freshman Seminar.** Current topics in biology in the context of total culture. Participants are required to do independent library research and present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 1 hour.
 199. **Undergraduate Open Seminar.** 0 to 9 hours.
 203. **Honors Seminar.** Lectures, student presentations, and discussions on selected topics of biology. Prerequisite: Junior or senior standing; 4.0 cumulative average; two courses in biology or consent of instructor. 1 hour. May be repeated once for credit.
 210. **Genetics.** Principles of heredity and the nature of genetic material. Credit is not given for Biology 210 and Biology 115 or Zoology 106. Prerequisite: Biology 111 or equivalent, or consent of instructor. 4 hours.
 211. **Developmental Biology.** Introduction to the basic mechanisms of organismic development as elucidated by descriptive and experimental methods. Prerequisite: Biology 111 or equivalent; Chemistry 133 or 234. 4 hours.
 251. **The Organism.** Study of the ways different classes of organisms respond to challenges of their environment. Emphasis placed on the general features of organismic behavior. Prerequisite: Biology 151; good standing in the Honors Biology Program; consent of Honors Biology Committee. 5 hours.
 305. **Principles of Taxonomy.** Discussion of the development and current status of principles of taxonomy in general, with a detailed consideration of the evolutionary processes producing animal taxa and the phylogenetic and statistical concepts pertinent to their classification. Prerequisite: Biology 210 or equivalent. 3 hours or 3/4 unit.
 307. **Immunology.** Introduction to fundamentals of immunology with emphasis on biological application. Provides a basic background for understanding immunological responses and techniques applicable to biological research. Prerequisite: Four semesters of college biology and Chemistry 133 or 234, or consent of instructor. 4 hours or 3/4 unit.
 308. **Experimental Immunobiology.** Introduction to immunological laboratory techniques for solving biological problems and experimental techniques in cellular immunology. Prerequisite: Credit or registration in Biology 307; consent of instructor. 3 hours or 3/4 unit.
 310. **Principles of Population Biology, I.** The sequence Biology 310 and 311 provides an integrated treatment of populational concepts in biology. Major topics: ecology, ethology, population genetics, and evolution. Prerequisite: Biology 210 or consent of instructor; college algebra. 3 hours or 3/4 unit.
 311. **Principles of Population Biology, II.** Continuation of Biology 310. Prerequisite: Biology 310 or consent of instructor. 3 hours or 3/4 unit.
 312. **Environmental Biology.** Lecture, laboratory, and field course dealing with the relation of organisms to their environments and physiological bases for responses, adaptations, and behavior. Introduction of ecosystems, biotic communities, and population dynamics. Emphasis on man and his interactions with environment. Prerequisite: One year of biology or consent of instructor. 5 hours or 1 unit.
 313. **Experimental Genetics.** Laboratory course to expose students to several types of organisms, experimental approaches, and methods of analysis utilized in genetical research. Prerequisite: Biology 151 or 210; consent of instructor. 3 hours or 3/4 unit.
 314. **Experimental Development.** Laboratory course to expose students to a variety of organisms, experimental approaches, and methods of analysis utilized in developmental research. Prerequisite: Biology 211 or 251, or Zoology 333; consent of instructor. 3 hours or 3/4 unit.
 351. **Population Biology.** Study of problems associated with behavior of plant and animal

- populations based on genetic, evolutionary, and ecological principles. Prerequisite: Biology 251; statistics; good standing in the Honors Biology Program; consent of Honors Biology Committee. 4 hours or 1 unit.
371. **Quantitative Biology.** Theory and practical application in biology of probability and statistics. Lectures and assigned problems. Prerequisite: College algebra; consent of instructor. 4 hours or 1 unit.
405. **Methods of Taxonomy.** A survey of basic procedure and techniques utilized in zoological classification. Major topics are assembly and arrangement of zoological materials, use of the fundamental taxonomic literature, descriptive and inferential statistical methods, data processing, and the interpretation and presentation of results and investigations. Prerequisite: Biology 305 or equivalent; a course in statistics. 3/4 unit.
409. **History of Biology.** The development of biological concepts from the classical Greek period to the present. Prerequisite: Consent of instructor. 1 unit.
411. **Discussions in Genetics and Cytogenetics.** 1/4 unit.
412. **Analysis and Control of Natural Environments.** Discussion and analysis of physiological, biochemical, and ecological aspects of environmental quality and of the problems of technology assessment. Emphasis is placed on the detection and characterization of environmental pollution, on the conservation of environmental quality and on the applied ecology of the plant and animal populations. Prerequisite: Biology 312 or consent of instructor. 3/4 unit.
418. **Concepts and Topics in Immunology.** Same as Veterinary Medical Science 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunologic tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor. Microbiology 327 and Biology 307 are recommended. 1/2 unit.
423. **Electron Microscopy.** Same as Chemistry 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission electron microscope and its modern variants, including lectures and demonstrations of modern high vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics; consent of instructor. 1/2 unit.
429. **Electron Microscopy with Laboratory.** Same as Chemistry 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate sections to meet special needs of biologists, geologists, and those interested in electron diffraction. Most theory lectures may be omitted by those enrolled or having credit in Biology or Chemistry 423. Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics; two semesters of college mathematics; three semesters of chemistry; consent of instructor. 1 unit.
430. **Biological Ultrastructure.** Lectures and reports on the fine structure of plant and animal cells and cell products with discussions of possible relationships of ultrastructure to function and of diverse interpretations of chemical-physical information as ultrastructure. Prerequisite: Consent of instructor. 1 unit. Offered in 1973-1974 and in alternate years.
440. **Advanced Plant Physiology, I.** A comprehensive presentation of current knowledge in plant physiology. First semester of a two-semester sequence covering cell organization and function, respiratory and photosynthetic mechanisms, transport processes, nutrition, biosynthesis, growth, development and reproduction. Prerequisite: Biochemistry 350 and 355; Botany 330 and 333, or consent of instructor. 1 unit.
441. **Advanced Plant Physiology, II.** A comprehensive presentation of current knowledge in plant physiology. Second semester of a two-semester sequence covering cell organization and function, respiratory and photosynthetic mechanisms, transport processes, nutrition, biosynthesis, growth, development and reproduction. Prerequisite: Biology 440. 1 unit.
490. **Special Topics in Biology.** Individual topics in research and/or reading conducted

under the supervision of faculty members in the School of Life Sciences. This course is particularly designed for students enrolled in the biology program who would like to become more familiar with specialized fields of study prior to committing themselves to a specific area for their doctorate degree. 1/2 to 2 units.

- 493. Advanced Electron Microscopy.** Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, and the analysis and study of varied materials by use of transmission and/or scanning electron microscopes, and by the techniques of electron diffraction. Open to qualified students in all departments. Prerequisite: Biology 429; consent of instructor. 1/4 or 1/2 unit.
- 499. Thesis Research.** 0 to 4 units.

Botany

Head of Department: Professor J. B. HANSON

Department Office: 297 Morrill Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Botany 100 or 101 and Zoology 104, or Biology 110-111 are required; also required are courses at the 200 or 300 level in each of the five major areas: genetics (Biology 210), taxonomy (Botany 260), morphology (Botany 304), ecology (Botany 381), and physiology (Botany 330), or their equivalents. Botany 300 (Individual Topics) taken for credit is required and participation in Biology 203 is recommended.

In addition, one semester of mathematics numbered 118 or above, one semester of organic chemistry, and one year of physics are required. Geology is recommended.

Minors: Twenty hours in one or two subjects chosen in consultation with the chairman of the department from the following: agronomy, chemistry, entomology, geography, geology, horticulture, mathematics, microbiology, physics, physiology, plant pathology, and zoology. At least eight hours must be taken in each subject if two are chosen.

If horticulture is chosen as a minor, not more than ten hours may be counted. The ten hours may be chosen from Horticulture 100, 110, 230 or 233, 242, 262, and 321 or 322.

- 100. General Botany.** Basic principles of growth and form, physiology, genetics, evolution, and ecology in plant biology. Students may not receive credit for both Botany 100 and 101. 4 hours. HANEY.
- 101. General Botany for Selected Students.** A course to provide instruction in the structure, physiology, reproduction, ecology, and economic importance of plants. Instruction is adjusted to the level of the selected student and consists of demonstration, discussion, and lecture. Admission to each section is limited to fifteen students. Students may not receive credit for both Botany 101 and 100. Prerequisite: James Scholar standing or consent of instructor. 5 hours.
- 234. Form and Function in Flowering Plants.** Lecture course on the physiological and morphological attributes that underlie the biosynthesis, growth, and reproduction of flowering plants in relation to the environment. Prerequisite: Botany 100 or 101, or a year of biology; Chemistry 102. 3 hours. HANSON.
- 260. Introductory Plant Taxonomy.** Classification and identification of flowering plants, with special reference to the local flora and the needs of high school teachers. Occasional field trips required. Prerequisite: Botany 100 or 101, or Biology 100 and 101, or Biology 111. 3 hours. PAYNE, SEIGLER.
- 300. Individual Topics.** For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than five hours in Botany 300 toward a bachelor's degree, nor graduate students more than one unit in Botany 300 toward a master's degree. Prerequisite: Botany 100; ten hours of advanced work in botany or another biological science; senior standing. 2 to 5 hours, or 1/4 or 1/2 unit.

304. **General Plant Morphology.** Lecture and laboratory course dealing with the structure, reproduction, and evolution of representative algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms. Prerequisite: Botany 100, Biology 111, Biology 101, or Biology 251, or consent of instructor. 4 hours or 1 unit. CAROTHERS, HOFFMAN, ROGERS.
305. **Comparative Morphology—Embryophytes.** A lecture and laboratory course dealing with the development, structure, reproduction, and evolution of bryophytes, lower vascular plants, and gymnosperms, with an introduction to angiosperms. One or two field trips. Prerequisite: Botany 345 and consent of instructor. 4 hours or 1 unit. Offered in 1973–1974 and in alternate years. PHILLIPS.
325. **Paleobotany.** Same as Geology 325. Structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips are included. Prerequisite: Botany 100 or Biology 101, and Geology 101; or consent of instructor. 5 hours or 1 unit. PHILLIPS.
330. **Plant Physiology.** General course concerned with plant functions, including water relations, mineral nutrition, metabolism, growth, and reproduction. Prerequisite: Chemistry 131; Botany 100, or Biology 101, or Biology 111, or Biology 251. 3 hours or 1/2 unit. GOVINDJEE, NANCE.
331. **Experimental Cytology.** Same as Zoology 331. Lectures on structure and function of the cell. Coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or 251; consent of instructor. 3 hours or 3/4 unit. DAVENPORT, STEFFENSEN.
333. **Plant Physiology Laboratory.** Same as Horticulture 333. Designed to serve the needs of those interested in acquiring familiarity with the techniques of experimental plant physiology. Prerequisite: Credit or registration in Botany 330 or equivalent; a course in organic chemistry. 3 hours or 3/4 unit. DICKINSON, NANCE.
334. **Experimental Cytology Laboratory.** Same as Zoology 334. Introduction to cytological techniques, microscopic analysis of macromolecules, isotopic techniques, autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or 1/2 unit. DAVENPORT, STEFFENSEN.
341. **Field Ecology.** Study of plant communities in various sections of North America during spring vacation. Trips rotate on a three- to five-year basis. Outdoor cooking and camping; transportation in University cars. Prerequisite: One of the following: Botany 260, 366, 381, and 385; consent of instructor. 1 hour or 1/4 unit. Course may be repeated for a maximum of 3 hours or 3/4 unit. HANEY.
345. **Plant Anatomy.** Study of the internal structure of vascular plants with special emphasis on development, function, and evolutionary history. Prerequisite: One year of botany. 4 hours or 1 unit. CAROTHERS.
350. **Phycology.** Introductory lecture and laboratory to the ecology, morphology, physiology, and systematics of the algae. Prerequisite: One year of botany or another biological science, or consent of instructor. 4 hours or 1 unit. HOFFMAN.
351. **Viruses, I.** Same as Microbiology and Zoology 351. General virology, emphasizing the statistical, physical, genetic, chemical, and biological properties of viruses. Prerequisite: Organic chemistry; biochemistry, calculus, and genetics recommended. 3 hours or 3/4 unit.
352. **Viruses, II.** Same as Microbiology and Zoology 352. Extension of the principles developed in Botany 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Botany 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or 3/4 unit. BLACK, MACLEOD, REICHMANN.
366. **Field Botany.** Identification and classification of native and naturalized flowering plants of eastern North America. Prerequisite: One course in botany; consent of instructor. 3 or 5 hours, or 1/2 or 1 unit. Offered in the summer session only.
372. **General Mycology.** Structure, classification, and identification of fungi, including those of economic importance. Prerequisite: One year of botany, entomology, microbiology, or zoology; senior standing or consent of instructor. 4 hours or 1 unit. ROGERS.
381. **Plant Ecology.** Principles of ecology exemplified by vegetation and environments of Illinois. Prerequisite: Botany 260 or equivalent. 5 hours or 1 unit. BAZZAZ.

- 402. Molecular Genetics: Chromosome Mechanics.** Same as Microbiology and Zoology 402. Structure and behavior of chromosomes (including replication, repair complementation, recombination, and mutation) with emphasis on microbial systems and molecular mechanism. Prerequisite: Microbiology 316 and 330, or consent of instructor. 3/4 unit.
- 403. Physiology of Fungi.** Same as Plant Pathology 403. Germination, growth, metabolism, and sporulation of fungi; physiology of fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products. The nature of fungicidal activity is discussed. Prerequisite: Organic chemistry or biochemistry; mycology, plant pathology, or microbiology. 1 unit. Offered in 1973–1974 and in alternate years. GOTTLIEB.
- 405. Molecular Genetics.** Same as Microbiology and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with intracellular transmission of genetic information, including gene regulation, transcription, and translation. Prerequisite: Microbiology 330; or Microbiology 316 plus biochemistry; or consent of instructor. 3/4 unit.
- 410. Botany Discussions.** All graduate students in botany, except those with conflicting teaching assignments, are required to register in and attend the general seminar. No credit is given except to those students presenting the results of their Ph.D. thesis research. 0 or 1/4 unit.
- 413. Discussions in Plant Physiology.** 1/4 unit.
- 414. Discussions in Plant Morphology and Taxonomy.** 1/4 unit.
- 418. Discussions in Plant Ecology and Plant Geography.** Developments in ecology and plant geography, with emphasis on one special division. Prerequisite: Graduate standing in botany, entomology, geography, or zoology. 1/4 unit. Total credit is limited to 1 1/2 units. BAZZAZ, HANEY.
- 419. Discussions in Photosynthesis and Related Topics.** Prerequisite: Consent of instructor. Students may accumulate 1 1/2 units. 0 or 1/4 unit. ARNTZEN, GOVINDJEE.
- 421. Cytogenetics.** Same as Zoology 421. Chromosome theory: structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210 or Microbiology 330, or consent of instructor. 1 unit. Offered in 1972–1973 and in alternate years. STEFFENSEN.
- 424. Mineral Nutrition of Plants.** Same as Agronomy and Horticulture 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in light of metabolic activity and constituency in functional plant compounds. Major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit. HAGEMAN.
- 427. Discussions in Mycology.** Seminar course designed for discussion of current research in the morphology, taxonomy, and physiology of fungi, especially the non-parasitic forms. Prerequisite: Consent of instructor. 1/4 unit.
- 433. Advanced Physiology of Growth, Responses, and Reproduction.** Prerequisite: Botany 330 or equivalent. 1 unit. DICKINSON, NANCE, WILSON.
- 436. Advanced Plant Physiology: Photosynthesis.** Same as Agronomy 436. Lecture and laboratory course dealing with physiological, biochemical, and biophysical aspects of photosynthesis. Prerequisite: One year each of college biology, chemistry, and physics, or consent of instructor. 1 unit. Offered in 1973–1974 and in alternate years. GOVINDJEE, OGRÉN.
- 442. Environmental Plant Physiology.** Same as Agronomy 442. Lecture course dealing with interaction of plants and environment at the level of the whole organism, extending to the cell and the community. Heat and mass transfer, plant and soil potentials, and effects of light on growth are emphasized. Prerequisite: Chemistry 131, general physics, general or plant physiology, and consent of instructor. 1 unit. BOYER.
- 460. Advanced Taxonomy of Flowering Plants, I.** Phylogenetic study of flowering plants; relationship of the principal orders and families; problems of nomenclature; identification of specimens. Prerequisite: Botany 260 or one year of botany or another biological

science, or consent of instructor. 1/2 or 1 unit. Offered in 1973–1974 and in alternate years. PAYNE.

461. **Advanced Taxonomy of Flowering Plants, II.** The application of cytology, ecology, genetics, and morphological analyses to the study of evolution and the natural relationships of populations as exemplified by species of higher plants. Prerequisite: Botany 260 and Biology 210, or equivalent; consent of instructor. 1 unit. Offered in 1972–1973 and in alternate years. SEIGLER.
462. **Origin of Variation in Plants.** Same as Agronomy 462. Study of the principles of plant evolution. Theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaption are discussed. Prerequisite: Consent of instructor. 1 unit. DEWET.
463. **Plant Products.** Lectures on the natural products from plants and the plant groups in which these compounds occur. Discussions include the biosynthesis, biological functions, relevant chemistry, toxicity, and economic importance of plant products. Prerequisite: Chemistry 350 or consent of instructor. 3/4 unit. SEIGLER.
471. **Advanced Mycology: Special Groups.** The several classes of fungi and their activities are considered in successive semesters. Special groups within these classes may be selected for concentrated study, depending upon the student's interest in mycology. Prerequisite: Botany 372 or consent of instructor. 1/2 unit. ROGERS.
482. **Ecological Methods.** Field and laboratory methods used in ecology. Prerequisite: One year of botany including Botany 381 or equivalent. 1 unit. Offered in 1972–1973 and in alternate years. BAZZAZ.
485. **Plant Geography of North America.** Study of principles of plant geography, plant distribution in relation to environment, and vegetational units of North America. Prerequisite: Botany 381 or equivalent. 1 unit. Offered in 1973–1974 and in alternate years. BAZZAZ.
493. **Advanced Studies in Botany.** 1/2 to 2 units. Not more than 1 unit may be applied toward the Graduate College master's degree requirement of three units of course work at the 400 level. Work may be taken in the following fields.
 - (a) **Anatomy.** CAROTHERS.
 - (b) **Biochemical Cytology.** STEFFENSEN.
 - (c) **Biological Rhythms.** SARGENT.
 - (d) **Cytogenetics and Speciation.** DEWET.
 - (e) **Ecology.** BAZZAZ, HANEY.
 - (f) **Genetics.** COX, LAUGHNAN, SARGENT, TUVESON.
 - (g) **Morphogenesis and Development.** SARGENT, VANDERHOEF.
 - (h) **Morphology.** CAROTHERS, PHILLIPS.
 - (i) **Mycology.** ROGERS, TUVESON.
 - (j) **Paleobotany.** PHILLIPS.
 - (k) **Photosynthesis.** ARNTZEN, GOVINDJEE.
 - (l) **Phycology.** HOFFMAN.
 - (m) **Physiology.** BOYER, DICKINSON, GOVINDJEE, HANSON, NANCE, VANDERHOEF.
 - (n) **Taxonomy.** PAYNE, SEIGLER.
 - (o) **Ultrastructure.** ARNTZEN, CAROTHERS, HOFFMAN.
 - (p) **Virology.** BLACK, MACLEOD.
499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

Entomology

Head of Department: Professor J. R. LARSEN

Department Office: 320 Morrill Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: This program is designed for students who wish to specialize in entomology as preparation for professional work in this area or subsequent graduate study.

Students must complete a major consisting of Biology 110, 111; Entomology 301, 302 (summer session); and an additional eleven hours of courses at the 200 or 300 level offered within the School of Life Sciences, chosen in consultation with the adviser. Students are also required to complete a year of physics, chemistry through organic with laboratory, a course in statistics, and mathematics through Mathematics 120 or equivalent. In addition, each student is strongly encouraged to carry on a program of research with a member of the department or with an entomologist at the State Natural History Survey.

Minor: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: agronomy, botany, chemistry, horticulture, microbiology, physics, physiology, and zoology.

- 101. Agricultural Entomology.** Lectures and discussion with laboratory practice in the recognition of agricultural pests for students of agriculture, covering methods of injury by insects, structure, physiology, metamorphosis, classification, and control; recognition, nature of injury, life history, habits, and control of the more common destructive or annoying pests of field crops, vegetables, fruits, stored products, and domestic animals. Counts for credit in technical agriculture. 3 hours.
- 103. Life of Insects.** Nontechnical course designed to give a balanced comprehensive picture of insect life; treats insect structures, growth, and relationships with other animal groups; life histories of the principal groups; modes of reproduction, movement, protection, communication, and behavior; interrelations with the physical and biotic environment, parasitism, transmission of diseases, predatism, pollination; how insects benefit and injure man, their control, and their roles in the history of man and in the arts. Credit is not given for both Entomology 103 and 118. 4 hours.
- 118. Insects, Man, and Environment.** Nontechnical course which considers basic aspects of entomology and ecology, especially as they relate to problems in the use of pesticides and environmental pollution. Credit is not given for both Entomology 118 and 103. 3 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 301. Introduction to Entomology.** Same as Zoology 301. Integrated studies of the principal morphological, physiological, and ecological relationship of insects. Prerequisite: Biology 111; Chemistry 131; consent of instructor. 5 hours or 1 unit.
- 302. Classification of Insects.** Comprehensive survey of the systematics and phylogeny of the orders and principal families of insects, with practical experience in identification of these taxa. Prerequisite: Consent of instructor. 4 hours or 1 unit. Offered in the summer session only.
- 306. Special Problems.** For students ready to undertake special investigation to be completed as an undergraduate study or the beginning of a thesis problem for an advanced degree. It also may be used to prepare a thesis for scholastic honors. Prerequisite: Consent of instructor. May be taken by students who can only attend classes on Saturday morning. 2 to 5 hours, or 1/4 to 1 unit.
- 312. Entomology for Teachers.** Recognition of the chief orders of insects in their immature and adult stages, how they develop, life cycles, food habitats, adaptations for feeding, oviposition, movement, protection, defense, making sound and other functions, interrelations with other organisms and the environment, social life. A collection of insects is mounted, labelled, and identified. Field trips, laboratory work, and discussions. Prerequisite: One year of biology, botany, zoology, or equivalent. 3 hours or 1/2 unit. Offered in the summer session only.
- 315. Insect Ecology.** Practical and theoretical aspects of ecology are discussed in relation to insects as individuals, populations, and communities, with emphasis on the role of insects in the environment. Prerequisite: Biology 312 or consent of instructor. 3 hours or 3/4 unit.
- 319. Fundamentals of Insect Control.** Emphasis on the principles underlying the control of important insect pests of agriculture and human and animal health. Study of integrated pest control involving biological, cultural, and chemical factors and of the ecology of the

- use of pesticides in the total environment. Prerequisite: Biology 111 and Chemistry 101, or equivalent; consent of instructor. 4 hours or 1 unit.
322. **Insect Bionomics.** Biology of insects dealing with life history and conditions of environment that favor abundance of insects representative of various habitats. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Horticulture and Zoology 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or 1/2 unit.
410. **Insect Morphology.** Comprehensive study of internal and external structure of insects from the comparative viewpoint. Prerequisite: Biology 111 or equivalent; consent of instructor. 1 unit.
413. **Medical and Veterinary Entomology.** Training in recognition, classification, methods of injury, habits, and control or destruction of insects, mites, and ticks which are predators, parasites, or disseminators of disease among men and domestic animals. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 1 unit.
420. **Chemistry and Toxicology of Insecticides.** Designed to provide fundamental information available concerning the mode of action, the relationship of chemical structure to toxicity, and the physiological explanation of the chemical poisoning of insects. Prerequisite: One year of biology, or equivalent in animal science; organic chemistry; consent of instructor. 1 unit.
422. **Insect Physiology.** Study of principal physiological and biochemical functions of insects, exclusive of sensory functions. Prerequisite: Entomology 302 and 410; organic chemistry; consent of instructor. 1 unit.
423. **Insect Behavior.** Analysis of the physiological basis of insect behavior, including a thorough study of the various sensory systems. Prerequisite: Entomology 301 or equivalent; consent of instructor. 1 unit.
424. **Advanced Insect Physiology.** Comprehensive study of physiological and biochemical interactions between the insect and its environment including sensory mechanisms, attractants and repellants, nutritional specialization, intermediary metabolism, energy production and utilization, metabolic activity accompanying functional changes, process controls. Prerequisite: Entomology 422; Chemistry 350; consent of instructor. 1 unit.
426. **Seminar in Entomology.** Discussions, reviews, and appraisals of special topics in the field of entomology. Prerequisite: Consent of instructor. 0 or 1/4 unit; may be repeated for a maximum of 1 unit.
499. **Thesis Research.** Work may be taken in the following subjects: morphology and embryology of insects, applied entomology, systematic entomology, biology and ecology of insects, insect toxicology, and insect physiology. 0 to 4 units.

Microbiology

Head of Department: Professor R. D. DEMOSS

Department Office: 131 Burrill Hall

REQUIREMENTS FOR I.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Biology 110 and 111 and twenty hours of microbiology courses including Microbiology 200 and 201. Biology 210 and 211 may be substituted for microbiology courses. In addition, quantitative and organic chemistry with laboratory, mathematics through trigonometry, and one year of physics are required. Credit must also be presented in one course to be selected from calculus, statistics, or computer science, and one course from physical chemistry or biochemistry.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: astronomy, biology, botany, chemistry, entomology, mathematics, physics, physiology, and zoology. No course may apply to both the major and the minor.

Departmental Distinction: Students become candidates for departmental distinction by (1) achieving an all-University average of 4.0, exclusive of military training and physical education; (2) achieving an average of 4.5 in courses included in the major and minor; and (3) completing at least four credit hours in Microbiology 207 in addition to the major.

SEQUENCE OF COURSES

Calculus, biochemistry, and genetics are strongly recommended. Organic chemistry with laboratory and required mathematics courses should be completed in the sophomore year. Students who elect microbiology as a major late in their college training should consult with a member of the department to arrange an appropriate schedule.

- 100. Introductory Microbiology.** Introduction to the principal activities and properties of microorganisms, including bacteria, yeasts, molds, and viruses. Consideration of the role of natural processes, such as photosynthesis, as well as man's use and control of microorganisms in the production of antibiotics and vaccines in industrial fermentations, in sanitation and public health, and in agriculture. Credit is not given for more than one of the following: Microbiology 100, Microbiology 113, Microbiology 200. 3 hours.
- 101. Introductory Experimental Microbiology.** Laboratory introduction to the techniques employed in the investigation of microbial activities and properties. Experiments designed to familiarize the student with the handling, identification, and characterization of microorganisms and their activities, particularly those of interest to man. Credit is not given for both Microbiology 101 and 201. The course terminates at mid-semester. Prerequisite: Credit or registration in Microbiology 100. 2 hours.
- 113. Man and Microbes.** General education biological science course for non-science majors which examines the effects of microbes on the activities of man. Emphasis is on environmental, economics and disease aspects of microbial activity on society. Presents microbiology as an example of a modern biological science. Credit is not given for more than one of the following: Microbiology 200, Microbiology 100, Microbiology 113. 3 hours.
- 200. Microbiology.** Emphasizes fundamental concepts of microbiology, including nutrition, ecology, and physiology of microorganisms, and their role in nature and in infection and immunity. Credit is not given for more than one of the following: Microbiology 200, Microbiology 100, Microbiology 113. Prerequisite: Credit or registration in organic chemistry with laboratory. 3 hours.
- 201. Experimental Microbiology.** Laboratory emphasizing the fundamentals of microbiology, including the biochemical basis of microbial physiology, ecology, and nutrition. Microbial genetics and gene-enzyme relationships are included. The experimental approach to microbiology is emphasized and encouraged. Credit is not given for both Microbiology 201 and 101. Prerequisite: Credit or registration in Microbiology 200 and in organic chemistry with laboratory. 3 to 5 hours.
- 207. Research and Special Problems.** Prerequisite: Fifteen hours of microbiology; consent of instructor. 3 to 5 hours. May be repeated for a maximum of 10 hours credit.
- 309. Comparative Microbial Chemistry.** Emphasis on comparative biochemical activity and other chemical characteristics as a basis for discussion of the features of major groups of microorganisms. Comparison of the energy metabolism of microbial groups is stressed. Prerequisite: Biochemistry 350 or equivalent. 2 hours or 1/2 unit.
- 311. Food and Industrial Microbiology.** Relationship of microorganisms to food manufacture and preservation and to industrial fermentation and processing and to sanitation. Prerequisite: Microbiology 101, 201, or 309, or equivalent and credit or registration in organic chemistry with laboratory, or consent of instructor. 3 hours or 3/4 unit.
- 312. Techniques of Applied Microbiology.** Consideration, through experimentation, of properties of bacteria, yeasts, molds, and actinomycetes important to industrial processes. Exploration of methods of control of microbial processes in industry and sanitation. Prerequisite: Credit or registration in Microbiology 311. 2 hours or 1/2 unit.

316. **Genetic Analysis of Microorganisms.** Prokaryotic and eukaryotic microbial genetic systems, emphasizing typical data analyses, together with the basic classes of genetic phenomena. Prerequisite: General genetics, Microbiology 200, or Microbiology 330. 3 hours or 3/4 unit.
326. **Pathogenic Bacteriology.** Study of parasitism and pathogenic microorganisms; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, methods of differentiation and recognition and diseases they cause. Lectures and laboratory. Prerequisite: Microbiology 101, 201, or 309; organic chemistry with laboratory. 5 hours or 1 unit.
327. **Immunochemistry.** Survey of the field of immunology with emphasis on its chemical aspects. Lectures and laboratory. Prerequisite: Credit or registration in biochemistry, or consent of instructor. 5 hours or 1 unit.
330. **Molecular Biology of Microorganisms.** Modern contributions to the science of microbiology, with emphasis on the structure, function, and synthesis of informational macromolecules and on the role microorganisms have played in molecular biology. Prerequisite: Microbiology 200 or equivalent; credit or concurrent registration in biochemistry. 3 hours or 3/4 unit.
331. **Microbial Physiology and Anatomy.** Discussions and problems concerning growth, physiology, anatomy, and death of microorganisms. Prerequisite: Microbiology 200 or equivalent; Biochemistry 350 or equivalent. 3 hours or 3/4 unit.
351. **Viruses, I.** Same as Botany and Zoology 351. General virology, emphasizing the statistical, physical, genetic, chemical, and biological properties of viruses. Prerequisite: Organic chemistry with laboratory; biochemistry and calculus recommended. 3 hours or 3/4 unit.
352. **Viruses, II.** Same as Botany and Zoology 352. Extension of the principles developed in Microbiology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Microbiology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or 3/4 unit.
402. **Molecular Genetics: Chromosome Mechanics.** Same as Botany and Zoology 402. Structure and behavior of chromosomes (including replication, repair, complementation, recombination, and mutation) with emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330 or consent of instructor. 3/4 unit.
405. **Molecular Genetics: Gene Action.** Same as Botany and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, including gene regulation, transcription, and translation. Prerequisite: Microbiology 330; or Microbiology 316 plus biochemistry; or consent of instructor. 3/4 unit.
409. **Cultivation and Properties of Microorganisms.** Nutritional and metabolic properties of the major groups of microorganisms; a comparative study of the ecology, selective isolation, and cultivation of bacteria. Laboratory. Prerequisite: Biochemistry 355 or equivalent; credit or registration in Microbiology 309; consent of instructor. 1 unit.
412. **Advances in Microbiology.** Discussions of current research in the following areas of microbiology: (a) general microbiology, (b) microbial physiology and metabolism, (c) immunochemistry, (d) molecular genetics. Prerequisite: Consent of instructor. 1/4 unit. May be repeated for a maximum of 1 unit.
419. **Animal Virology.** Same as Veterinary Medical Science 419. Discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327 or Veterinary Medical Science 331 and 332; Biochemistry 350 or 354; consent of instructor. 3/4 unit.
420. **Chemistry of Microbic Processes.** Properties of microorganisms with emphasis on metabolic pathways and chemical processes involved in the release of energy in the dissimulation of substrates by fermentation and respiration, and in the synthesis of cellular constituents. Metabolic types represented by microorganisms including the heterotrophic, autotrophic, and photosynthetic patterns are included. Prerequisite: Microbiology 309 or 330 and Biochemistry 350, or equivalent; consent of instructor. 3/4 unit.

451. **Experimental Virology.** Experiments on the biology, replication, and genetics of bacteriophages, with emphasis on experimental design by the student. Prerequisite: Microbiology 351; consent of instructor. 1 unit.
490. **Individual Problems.** Consent of instructor. 1/2 to 2 units.
495. **Seminar.** Required of all graduate students whose major is microbiology. Prerequisite: Ten hours of microbiology; consent of instructor. 0 or 1/4 unit.
499. **Thesis Research.** 0 to 4 units.

Physiology and Biophysics

Head of Department: Professor W. W. SLEATOR

Department Office: 524 Burrill Hall

Physiology

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in animal physiology or, with approval of the adviser, upper division courses in genetics, biochemistry, biophysics, and plant physiology, not including elementary courses and including Physiology 301, General Physiology; Physiology 303, General Physiology Laboratory; Physiology 302, Experimental Animal Physiology; and Physiology 304, Experimental Physiology Laboratory. The student's program must include a year of general biology, including both animal and plant biology; a semester of genetics; mathematics through elementary calculus; two semesters of physics; and four semesters of chemistry, including general, inorganic, organic with laboratory, and quantitative chemistry. Microbiology, embryology, histology, physical chemistry, and biochemistry are strongly recommended.

Minors: Twenty hours in physics, chemistry, microbiology, or zoology, provided, if two minors are chosen, at least eight semester hours are offered in the lesser.

Honors: To earn departmental distinction at graduation, the candidate must enroll in Physiology 290 and, working with a departmental adviser, prepare a report based on laboratory or library research. This report will be submitted to a committee composed of the honors adviser, one member from physiology, and one member from biophysics. They will recommend to the departmental faculty the level of distinction.

103. **Introduction to Human Physiology.** Functioning of cells and organ systems as the basis of human life. Particular attention given to the physiology of integrative systems (nervous and endocrine) and to regulative roles of the circulatory, respiratory, excretory, and digestive systems. Credit is not granted to students who have completed Physiology 203 or equivalent. Prerequisite: Chemistry 100 or equivalent. A familiarity with the principles of biology is recommended. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
234. **Human Anatomy and Physiology.** Study of the essentials of anatomy and physiology with special reference to muscular and nervous systems. Prerequisite: Physiology 103 or consent of instructor. 5 hours.
290. **Reading and Individual Topics Course.** Readings or laboratory work in fields chosen in consultation with a departmental faculty sponsor. Must be taken in partial fulfillment of departmental honors requirements. Prerequisite: A course in physiology; consent of instructor. 2 to 4 hours. May be repeated for up to 10 hours credit.
291. **Discussions in General Physiology.** Discussions of selected topics in general physiology. Prerequisite: Credit or registration in Physiology 301; consent of instructor. 2 hours.
292. **Discussions in Animal Physiology.** Discussions of selected topics in animal physiology. Prerequisite: Credit or registration in Physiology 302; consent of instructor. 2 hours.
301. **General Physiology.** A consideration from the standpoint of experimental biology of functions that are common to most eukaryotic cells. Prerequisite: Biology 111 or 251,

- or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or 3/4 unit.
302. **Experimental Animal Physiology.** Organ physiology of animals with emphasis on homeostasis and physiological interactions of animals with their environment. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or 3/4 unit.
303. **General Physiology Laboratory.** An introduction to experimentation with cellular functions that are common to most eukaryotic cells, with emphasis on biochemical, radioactive tracer, electrical, and mechanical recording techniques. Prerequisite: Credit or registration in Physiology 301. 2 hours or 1/4 unit.
304. **Experimental Physiology Laboratory.** Introduction to problems and techniques for studying the physiology of organ systems. Prerequisite: Credit or registration in Physiology 302. 2 hours or 1/4 unit.
305. **Principles of Ergonomics.** Same as Industrial Engineering and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work. Such topics as static and dynamic forces on the human frame, response to environmental stress (heat, vibration, noise), vigilance and fatigue, and man-machine systems are considered. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Industrial Engineering and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments. Students become familiar with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
312. **Endocrinology.** Same as Zoology 312. Physiology and biochemistry of the endocrine system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or 3/4 unit.
331. **General Radiobiology.** Response of multicellular organisms, cells, and macromolecules of ionizing radiations. Lectures, student reports, and discussions. Prerequisite: One year each of mathematics, physics, chemistry, and biology. 4 hours or 1 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. Term paper required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Physiology 369. 4 hours or 1 unit.
401. **Physiology of Systems and Organs.** Analysis of organization and function of vertebrate systems, combining the viewpoints of traditional cellular, comparative, mammalian, and human physiology; nervous, circulatory, digestive, and excretory systems; gross metabolism. Prerequisite: One year of college-level physics; chemistry through organic; an upper division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.
402. **Comparative and Adaptational Physiology.** Analysis of mechanisms of adaptation to the environment and to environmental stress, combining viewpoints of traditional cellular, mammalian, and human physiology, with particular emphasis on the comparative

approach. Homeostatic theory, nutrition, osmotic and ionic regulation, respiration and metabolism, temperature relations, sense organs, contractile systems. Prerequisite: One year of college-level physics; chemistry through organic; an upper division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.

403. **Cellular and Molecular Physiology.** Physicochemical analysis of cellular function and structure and consideration of the implications of the properties of cells for the physiology of multicellular animals. Students may enroll for the lecture series on physiology of cytoplasm and the nucleus, cell growth and division and cellular regulatory mechanisms and/or the lecture series on cellular ultrastructure, physiology of cell membranes, bioelectrics, and motility. Prerequisite: One year of college-level physics; chemistry including physical and biochemistry; an upper division course in physiology; knowledge of calculus presumed. 1/2 or 1 unit.
404. **Physiological Measurements.** Same as Biophysics 404. Laboratories concerned with an introduction at a graduate level to current research techniques in the physiological and biophysical sciences. Laboratories problem-oriented and students select up to four special topics representing different areas of physiology and biophysics, e.g., mammalian and human, molecular, cellular and radiation biology, comparative physiology and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. 1/4 to 1 unit. May be repeated to a maximum of 11/2 units.
410. **Mammalian Physiology Seminar.** Current trends in mammalian physiology. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1/2 unit.
412. **Advanced Endocrinology.** Same as Animal Science, Dairy Science, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312; consent of instructor. 1/2 unit. May be repeated for credit not to exceed a total of 2 units.
413. **Experimental Mammalian Physiology, I.** Same as Veterinary Medical Science 413. Physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
414. **Experimental Mammalian Physiology, II.** Same as Veterinary Medical Science 414. Physiological applications of experimental pharmacodynamics. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
416. **Structure and Function of the Nervous System.** Understanding of nervous function through the experimental approach. Prerequisite: Two semesters of physiology courses beyond the elementary level; two semesters of general physics; consent of instructor. 1 unit.
421. **Gross Human Anatomy.** General survey of the structures of the human body with emphasis on the relations between form and function. Prerequisite: One semester of embryology; consent of instructor. 1 unit.
431. **Experimental Radiobiology.** Laboratory exercises in irradiation procedures and in examination of biological responses to ionizing radiations. Prerequisite: Physiology 331 or equivalent; consent of instructor. 1 unit.
441. **Advanced Comparative Physiology.** Same as Zoology 441. Seminar, lectures, student reports, discussions. Prerequisite: Consent of instructor. 1/2 unit.
442. **Advanced Comparative Physiology Laboratory.** Same as Zoology 442. Laboratory experiments presenting comparative principles in osmotic and ionic regulation, respiration and metabolism, temperature regulation of animals, physiology of circulatory systems, of muscle, of sense organs and nervous systems. Prerequisite: Physiology 402, 403, and 404; credit or registration in Physiology 441. 1 unit.
451. **Advanced Cellular Physiology.** Same as Zoology 451. Seminar, lectures, student reports, discussions. Prerequisite: Consent of instructor. 1/2 unit.
461. **Fundamentals of Bioclimatology.** Same as Geography 461. Effects of physical factors (such as barometric pressure, temperature, humidity, radiation, and air movement) on physiological processes in mammals; and the application of meteorological, climatologi-

- cal, and geographical techniques in physiological studies. Prerequisite: Consent of instructor. 3/4 unit.
462. **Experimental Bioclimatology.** Same as Geography 462. Laboratory work and demonstrations on methods of measuring meteorological factors, of clinical thermometry, and partitioned calorimetry; laboratory work on physiological adjustments of man to heat, cold, and high altitude. Prerequisite: Physiology 301, or Physiology 401 and 402; credit or registration in Physiology 461. 1/2 unit.
464. **Advanced Human Bioclimatology.** Same as Geography 464. Topics in human bioclimatology and medical geography, such as climatic determinism, meteorotropism, the weather elements as stresses, and acclimatization. Prerequisite: Physiology 461. 1/2 unit.
470. **Human Pathologic Physiology.** Disturbances of function in tissues and organs and their relationship to the pathogenesis of human disease. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. 3/4 unit.
472. **Human Physiology Seminar.** Topics of current emphasis in human physiology. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. 1/2 unit.
473. **Ergonomics Seminar.** Same as Industrial Engineering and Physical Education 473. Topics in ergonomics explored in depth, such as effects of vibration on human performance and biomechanics of the hand. Prerequisite: Physiology, Physical Education, or Industrial Engineering 306 or consent of instructor. 1/2 unit.
491. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Approval of department. 1/2 to 2 units.
499. **Thesis Research.** 0 to 4 units. Research may be conducted in the following areas, with the consent of the instructor.
- (a) **Cellular Physiology.** ANDERSON, BARR, BUETOW, CONNOR, DUCOFF, GORSKI, KATZENELLENBOGEN, PROSSER, SLEATOR, WILLIS.
 - (b) **Comparative Physiology.** ANDERSON, HEATH, KATZENELLENBOGEN, LARSEN, PROSSER, SWEENEY, WILLIS.
 - (c) **Mammalian Physiology.** ADES, BARKER, GIANTURCO, NALBANDOV, TWARDOCK, ZEHR.
 - (d) **Human Anatomy and Human Physiology.** HARRIS, JOHNSON, STOLPE.
 - (e) **Endocrinology.** GORSKI, KATZENELLENBOGEN, NALBANDOV, STOLPE.
 - (f) **Neurophysiology.** ADES, BARKER, DONCHIN, HEATH.
 - (g) **Radiobiology.** DUCOFF, GIANTURCO, TWARDOCK.
 - (h) **Environmental and Stress Physiology.** HARRIS, HERTIG, JOHNSON.

Biophysics

199. **Undergraduate Open Seminar.** 0 to 9 hours.
301. **Introduction to Biophysics.** Review of the field of biophysics designed to introduce the student to types of biological problems currently under investigation in biophysics laboratories. Prerequisite: Eight hours of physics. 3 hours or 3/4 unit.
312. **Introduction to Radiobiology.** Nature and mechanisms of the biological consequences of low dose and chronic irradiation. Intended primarily for students in engineering and physical sciences. Prerequisite: Mathematics 141 or Mathematics 140 and 145; eight hours of physics; consent of instructor. 2 hours or 1/2 unit.
401. **Advanced Biophysics, I.** Topics from membrane biophysics and bioenergetics. Prerequisite: Credit or registration in Physiology 403; one year of physics beyond introductory physics, or equivalent; calculus; consent of instructor. 1 unit.
402. **Advanced Biophysics, II.** Topics from electrophysiology, nerve and muscle biophysics, response of biological systems to radiation phenomena (ionizing and mechanical). Prerequisite: Biophysics 401 or consent of instructor. 1 unit.
404. **Physiological Measurements.** Same as Physiology 404. Laboratories concerned with an

introduction at a graduate level to current research techniques in physiological and biophysical sciences. Laboratories problem-oriented and students select up to four special topics representing different areas of physiology and biophysics, e.g., mammalian and human, molecular, cellular and radiation biology, comparative physiology and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. 1/4 to 1 unit. May be repeated to a maximum of 11/2 units.

406. **Principles of Biophysical Measurements.** Lecture course designed to acquaint the student with physical methods useful in the solution of biological problems. Topics covered are bioelectric measurements, including basic electronics; optical methods, including microscopy, spectrophotometry, and measurement of action spectra; use of high energy radiations; tracer techniques; acoustical techniques. Prerequisite: Consent of instructor. 1/4 unit.
410. **Special Topics in Biophysics.** Advanced course on some topic of interest in biophysics, such as electrobiology, radiation biology, photobiology, bioacoustics, or the physics of muscular contraction. Prerequisite: Biophysics 401 and 402, or equivalent. 1/2 to 1 unit.
411. **Seminar.** Survey of literature in one area of biophysics, with special emphasis on student reports. Prerequisite: Enrollment in the biophysics program or consent of instructor. 1/2 unit.
436. **Problems of Cybernetics.** Same as Communications 436 and Electrical Engineering 474. Study of brain-like processes in complex dynamic systems with emphasis on unsolved problems, current developments, and opportunities for research. Prerequisite: Consent of instructor. 1 unit.
463. **Radioisotopes in Biological Research: Principles and Practice.** See Veterinary Medical Science 463. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, biology, and/or consent of instructor. 3/4 unit.
491. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Consent of instructor. 1/2 to 2 units.
499. **Thesis Research.** 0 to 4 units. Research may be conducted in one of the areas listed below, subject to approval of the staff member concerned and the department in which the research is to be done.
 - (a) **Bioacoustics.** DUNN.
 - (b) **Electrobiology.** BARR, CONNOR, PROSSER, SLEATOR.
 - (c) **Physical Properties of Lipids and Membranes.** BARR.
 - (d) **Lipid Biophysics, Model Membranes, and Pollution Effects.** JENDRASIAK.
 - (e) **Photobiology and Photosynthesis.** GOVINDJEE.
 - (f) **Physics of Muscular Contraction.** BARR, PROSSER, SLEATOR.
 - (g) **Radiobiology.** DUCOFF, TWARDOCK.
 - (h) **Information Theory and Cybernetics.** VON FOERSTER.
 - (i) **Ion Transport and Permeability.** BARR, JENDRASIAK, WILLIS.
 - (j) **Mechanical Properties of Tissues.** DUNN.
 - (k) **Biophysical Chemistry.** WEBER.

Zoology

Head of Department: Professor R. L. METCALF

Department Office: 287 Morrill Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Biology 110 and 111, or equivalent, and twenty hours in courses at the 200 level or above offered within the School of Life Sciences. The twenty hours must include at least twelve hours of credit in zoology courses and at least two laboratory or field courses in life sciences. Up to eight hours of Zoology 303 (Individual Topics) or equivalent will be accepted

for graduation credit, but no more than five of these hours may be counted against the twenty-hour requirement in the major. Also required are one year of physics, at least three semesters of chemistry including organic with laboratory, and Mathematics 120 or equivalent. Courses in biochemistry, calculus, and statistics are highly recommended.

Minor: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: animal science (to be chosen from courses 100, 110, 230, 305, or 330), anthropology, biochemistry, botany, chemistry, education, entomology, geography, geology, mathematics, microbiology, physics, physiology, psychology.

104. **Elementary Zoology.** Fundamental principles of the structure, physiology, reproduction, ecology, and evolution of animals, with special emphasis on their relations to human life. This course with Botany 100 meets the biology requirement for students in agriculture. 4 hours.
105. **The Ecosystem Concept.** Introduction to ecological principles with particular emphasis on man in relation to his global environment. Evolution of man and the human ecosystem, effects of human population growth, energy production, and natural resource utilization are considered as they affect global cyclic mechanisms. 3 hours.
106. **Principles of Heredity.** Introduction to genetics and the laws of inheritance with special emphasis on man; the relationship of genetics to human affairs. No biological training required. Credit is not given for Zoology 106 and Biology 115 or 210. Prerequisite: Sophomore standing. 3 hours.
107. **Evolution.** Analysis of the theories of evolution, the mechanism of evolutionary changes and the evolution of man. Credit is not given for both Zoology 107 and Biology 115. Prerequisite: Sophomore standing. 3 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology and Psychology 143. Critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication and social organization, and parental, sexual, and aggressive behavior. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
232. **Comparative Vertebrate Anatomy.** Classification and comparative anatomy of vertebrates including functions, and evolution of their organs and organ systems. Prerequisite: Biology 111 or equivalent. 5 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology and Sociology 246. Introduction to the biosociology of vertebrates. Emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
300. **General Seminar.** For members of the staff and graduate students. Required of all graduate students but also open to seniors whose major is zoology. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar, Endocrinology Seminar, and Protozoology-Parasitology Seminar. No credit.
301. **Introduction to Entomology.** Same as Entomology 301. Devoted to integrated studies of the principal morphological, physiological, and ecological relationship of insects. Prerequisite: Biology 111; Chemistry 131; consent of instructor. 5 hours or 1 unit.
303. **Individual Topics.** For those wishing to study individual problems. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. Prerequisite: Two years of zoology; senior standing; approval of department. May be taken by students who can attend classes only on Saturdays. 2 to 5 hours, or 1/2 or 1 unit.
304. **Field and Systematic Zoology.** Collection, preservation, and identification of lower vertebrates and land and fresh-water invertebrates: habits and life histories of selected forms. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.
312. **Endocrinology.** Same as Physiology 312. Physiology and biochemistry of the endocrine

system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or 3/4 unit.

318. **Protozoology.** Basic treatment of the morphology, physiology, and systematics of the protozoa; also, consideration of their evolution, ecology, morphogenesis, sexual phenomena, genetics, and parasitism with life histories of selected free-living and parasitic forms. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
320. **Invertebrate Zoology.** Invertebrates: structure and development. Application of biological principles. Specific and comparative morphology of the invertebrates; coordination of structure and function, origin, development, and life histories. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
321. **Parasitology.** Worm parasites, life cycles, morphology, taxonomy, environmental relations. Lecture, laboratory, technic, readings, quiz, demonstrations, problems. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
330. **Practical Microtechnique.** Introduction to microscopy, microphotography, and histological technique. Prerequisite: Histology or embryology; consent of instructor. 3 hours or 1/2 unit.
331. **Experimental Cytology.** Same as Botany 331. Lectures on structure and function of the cell. Coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or equivalent; consent of instructor. 3 hours or 3/4 unit.
332. **Advanced Vertebrate Zoology.** Vertebrate morphology; comparative anatomy, evolution, and function of vertebrate organ systems, with special emphasis on the evolution, anatomy, and function of the skeletal and nervous systems. Lectures and laboratory. Prerequisite: Zoology 232. 5 hours or 1 unit.
333. **Vertebrate Embryology.** Development of the vertebrate body and its organs. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
334. **Experimental Cytology Laboratory.** Same as Botany 334. Introduction of cytological techniques, microscopic analysis of macromolecules, isotopic techniques, and autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or 1/2 unit.
335. **Ornithology.** Structure, functions, environmental relations, habits, life history, and identification of birds. Laboratory during first eight weeks and field trips during last eight weeks of the semester. Prerequisite: Biology 111 or equivalent. 3 hours or 1/2 unit.
336. **Mammalogy.** Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. Prerequisite: Zoology 232, 4 hours or 1 unit.
337. **Ichthyology.** Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or 1/2 unit.
338. **Herpetology.** Classification, distribution, life history, and identification of reptiles and amphibians, particularly those of the United States. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or 1/2 unit. Offered in 1972-1973 and in alternate years.
340. **Natural History of the Vertebrates.** Lecture: vertebrate adaptations. Lab and field trips; identification, distribution, life histories, with emphasis on vertebrates of Illinois. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
341. **Field Ecology.** Study of biotic communities, mammals, birds, reptiles, amphibia, fishes, and invertebrates in various sections of North America during spring vacation. Outdoor camping and cooking. Transportation in University cars. Prerequisite: Credit or registration in one of the following: Zoology 304, 335, 336, 337, 338, 340, 345; consent of instructor. 1 hour or 1/4 unit. May be repeated for a maximum of 3 credit hours.
342. **Wildlife Management and Conservation.** Size and measurement of animal population, factors affecting reproduction and mortality, life history, management policies for fishes, mammals, and birds. Prerequisite: Biology 111 or equivalent. 3 hours or 1/2 unit.
343. **Limnology.** Fresh water biology. Study of the lake, pond, and river with emphasis on

the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.

344. **Introduction to Primate Morphology and Behavior.** Same as Anthropology 343. Survey of primate social behavior and the classification, morphology, and distribution of living and extinct species. Emphasis on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240, Zoology 246, or consent of instructor. 2 hours, or 1/2 or 1 unit. KLEIN.
345. **Animal Ecology.** Study of the relationships between organisms and their environment with major emphasis on population dynamics and ecosystem functions and their significance to human populations. Prerequisite: Biology 312 or consent of instructor. 4 or 5 hours, or 3/4 or 1 unit. Four hours or 3/4 unit credit requires field work on six Saturdays; 5 hours or 1 unit requires field work on ten Saturdays, including one weekend field trip.
346. **Ethology.** Same as Anthropology 346 and Animal Science 346. Introduction to description and experimental analysis of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or 3/4 unit.
347. **Ethology Laboratory.** Same as Anthropology 347 and Animal Science 347. Laboratory in ethology. Prerequisite: Zoology 346 and consent of instructor. 3 hours or 3/4 unit.
348. **Physiological Basis of Behavior.** Physiological mechanisms underlying behavior, as determined through comparative studies. Topics include the functional organization of nervous systems, neurosecretion and synaptic chemistry, sensory physiology, and integration. Prerequisite: Zoology 346 or Psychology 345; Physiology 301 or 302. 3 hours or 3/4 units.
349. **Ecology and Evolution of Social Structure.** Evaluation of the interplay between social organizations and ecologic factors with emphasis on evolutionary mechanisms and consequences. Prerequisite: Zoology 346; Biology 310. 3 hours or 3/4 unit.
350. **Behavior-Genetic Analysis.** Concepts, methods, and problems in analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240, Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or 3/4 or 1 unit.
351. **Viruses, I.** Same as Microbiology and Botany 351. General virology, emphasizing the statistical, physical, genetic, chemical, and biological properties of viruses. Prerequisite: Organic chemistry with laboratory; biochemistry, calculus, and genetics recommended. 3 hours or 3/4 unit.
352. **Viruses, II.** Same as Botany and Microbiology 352. Extension of the principles developed in Zoology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Zoology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or 3/4 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Entomology and Horticulture 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or 1/2 unit.
367. **Analysis of Development.** Advanced study of basic problems in developmental biology. Major emphasis on interactions at molecular, fine structural, and cellular levels, and the genetic and metabolic mechanisms by which these interactions are controlled in plants and animals. Theories of differentiation are critically examined in light of recent research. Lectures, discussions, outside readings, and student reports. Prerequisite: Biology 211 or Zoology 333; Biology 210; organic chemistry. 3 hours or 3/4 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, and Veterinary Medical Science 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one

year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.

393. **Laboratory in Primate Social Behavior.** Same as Anthropology and Psychology 393. Introduction to the observational analysis of comparative primate communication and social behavior. Instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Zoology 344 or consent of instructor. 3 hours, or 3/4 or 1 unit.
402. **Molecular Genetics: Chromosome Mechanics.** Same as Botany and Microbiology 402. Structure and behavior of chromosomes (including replication, repair, and complementation, recombination, and mutation) with emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330 or consent of instructor. 3/4 unit.
405. **Molecular Genetics.** Same as Botany and Microbiology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, including gene regulation, transcription, and translation. Prerequisite: Microbiology 330, or Microbiology 316 plus biochemistry, or consent of instructor. 3/4 unit.
406. **Physiology of Reproduction.** Same as Animal Science 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit.
407. **Evolutionary Theory.** Genetic, systematic, ecological, and zoogeographical concepts as related to the process of evolution. Prerequisite: One course in genetics; consent of instructor. 1 unit.
408. **Laboratory Methods in Physiology of Reproduction.** Same as Animal Science 408. Prerequisite: Consent of instructor. 1/2 to 1 unit.
410. **Theoretical Population Biology.** Detailed examination of structure and process in population biology integrating population ecology and genetics and emphasizing theoretical concepts, quantitative relationships, and recent developments. Prerequisite: Calculus; credit or registration in Biology 311; consent of instructor. Statistics highly recommended. 1 unit.
412. **Advanced Endocrinology.** See Physiology 412. Prerequisite: Physiology 312; consent of instructor. 1/2 unit. Course may be repeated for credit not to exceed a total of 2 units.
418. **Advanced Protozoology.** Advanced consideration of selected topics, with emphasis on laboratory practice in modern methods and techniques of studying both free-living and parasitic protozoa; collecting, culturing, and staining of representative forms. Prerequisite: Zoology 318 or equivalent. 1 unit. Offered in 1972-1973 and in alternate years.
419. **Topics in Experimental Protozoology.** Consideration of the advantageous employment of protozoa in modern researches concerned with basic biological problems; selected experimental topics covered by lectures, demonstrations, discussions, reports, and readings. Prerequisite: Consent of instructor. 1/2 or 1 unit. Offered in 1973-1974 and in alternate years.
420. **Experimental Invertebrate Zoology.** Study of current research problems and practice in the experimental methods used in the area of invertebrate zoology. Prerequisite: Zoology 320 or equivalent; consent of instructor. 1 unit. SWEENEY.
421. **Cytogenetics.** Same as Botany 421. Chromosome theory: the structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210, or Microbiology 330, or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
422. **Advanced Parasitology.** Advanced study of modern methods in helminthology. Prerequisite: Zoology 321 or equivalent. 1 unit.
425. **Experimental Parasitology.** Same as Veterinary Medical Science 425. Broadly based consideration of the relation of parasites to their hosts and to their environments, and

of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Chemistry 350; biochemistry and statistics are recommended. 1 unit.

433. **Topics in Developmental Biology.** Study of initial differences in developing systems and interactions leading to more complex differences. May be elected in successive years. Prerequisite: Zoology 367. 1/4 unit. Maximum credit for master's candidates, one unit; for doctoral candidates, three units.
441. **Advanced Comparative Physiology.** Same as Physiology 441. Seminar, lectures, student reports, discussions. Prerequisite: Consent of instructor. 1/2 unit.
442. **Advanced Comparative Physiology Laboratory.** Same as Physiology 442. Laboratory experiments presenting comparative principles in osmotic and ionic regulation, respiration and metabolism, temperature regulation of animals, physiology of circulatory systems, of muscle, of sense organs and nervous systems. Prerequisite: Physiology 402, 403, and 404; credit or registration in Physiology 441. 1 unit.
443. **Problems in Primate Behavior and Ecology.** Same as Anthropology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects. Topics will vary each semester. Prerequisite: Consent of instructor. 1 unit. May be repeated for additional credit.
444. **Concepts of Ethology.** Group discussion of problems such as stimulus filtering, spontaneity, and stereotyped motor patterns, with a new topic each semester. Prerequisite: Zoology 346. 1/2 unit.
445. **Seminar in Fish and Wildlife Ecology.** Modern ecological principles and concepts to specific problems in fisheries and wildlife. Prerequisite: Zoology 342 or 345, or equivalent. 1/2 unit. Offered in 1972-1973 and in alternate years.
446. **Physiological Ecology.** Physiological adjustments and responses of organisms to their environment. 1 unit.
451. **Advanced Cellular Physiology.** Same as Physiology 451. Seminar, lectures, student reports, discussions. Prerequisite: Consent of instructor. 1/2 unit.
467. **Experimental Embryology.** Prerequisite: Zoology 367. 1 unit.
490. **Individual Research.** For master's degree candidates who elect to write a research report rather than a thesis. Prerequisite: Consent of adviser. 1/2 to 3 units. No more than 3 units may be included in the master's degree program.
491. **Topics in Population Biology.** Seminar course devoted to discussion of problems in population biology, with a different topic each semester. Prerequisite: Consent of instructor. 1/2 unit. Total credit is limited to 4 units.
499. **Thesis Research.** 0 to 4 units. Work in the following fields is offered for students registered in Zoology 499:

Anatomy, Physiology, and General Classification of Vertebrates. Endocrinology, HALL, NALBANDOV; Functional Anatomy, FRAZZETTA; Histology, DAVENPORT; Ultrastructure, HALL; Vertebrate Physiology, HEATH, PROSSER.

Anatomy, Physiology, and General Classification of Invertebrates. Helminthology, KRUIDENIER, LEVINE, SILVERMAN; Invertebrate Zoology, MATTESON, SWEENEY; Invertebrate Physiology, PROSSER, SWEENEY; Parasitology, ALGER, KRUIDENIER, SILVERMAN. **Embryology and Basic Knowledge of Cells and Tissues.** Cytology, DAVENPORT; Embryology and Regeneration, DAVENPORT, STOCUM, WATTERSON; Toxicology, INGLE, METCALF.

Principles of Ecology, Principles of Taxonomy, Natural History. Ecology, BATZLI, GETZ, GHENT, KENDEIGH, WILLSON; Ethology, BANKS, HIRSCH, KLEIN, LARIMORE, SALMON; Ichthyology, SHOEMAKER, P. SMITH, UNZICKER; Limnology, BENNETT, MATTESON; Mammalogy, HOFFMEISTER, LEE; Ornithology, KENDEIGH, WILLSON; Taxonomy, EADES; Wildlife Management, KENDEIGH, SANDERSON, SHOEMAKER.

Genetics and Evolution. Genetics and Evolution, BROWN, DANIEL, KITZMILLER, NANEY, WHITT; Vertebrate Phylogeny and Paleontology, FRAZZETTA.

LINGUISTICS

(Including Arabic, Hindi, Modern Greek, Modern Hebrew, Swahili, and Yoruba)

Head of Department: Professor B. B. KACHRU

Department Office: 4088 Foreign Languages Building

Linguistics

Note: An undergraduate linguistics major has been proposed and is pending approval. Students interested in studying linguistics should consult the department.

198. **Freshman Seminar.** A research-oriented survey of the fundamentals of general linguistics and the role of languages in culture and society. Emphasis on South Asia. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours. B. KACHRU.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elements of Linguistics.** Same as Anthropology 200. An elementary survey of the methods used in descriptive and historical linguistic analysis, with application to languages usually taught in college. Prerequisite: One year of a foreign language or equivalent. 3 hours.
201. **Elements of Phonology.** An introduction to the formal description of phonological structure, including study of articulatory phonetics, the phonological feature framework, and fundamental concepts of generative phonological theory. Prerequisite: Credit or registration in Linguistics 200 or consent of instructor. 3 hours.
202. **Elements of Syntax.** An introduction to the types of syntactic and semantic phenomena found in natural language, with material drawn from a variety of languages. Emphasis is on the implications of such phenomena for linguistic theory; formalism and application of generative grammar. Prerequisite: Credit or registration in Linguistics 200 or consent of instructor. 3 hours.
220. **Language in African Culture and Society.** An introduction to the sociolinguistic context of Africa with special emphasis on the study of selected African languages for understanding the African cultural heritage. A critical discussion on African oral literary tradition, language variety, language attitude, language standardization, and other linguistically relevant language problems. 3 hours. STAHLKE.
225. **Elements of Psycholinguistics.** Introduction to the theory and methodology of psycholinguistics with emphasis on language acquisition and linguistics behavior. 3 hours.
300. **Introduction to Linguistics.** Same as Anthropology 300. An introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or 1/2 unit.
301. **Introduction to General Phonetics.** An introduction to the main branches of general phonetics and phonological theory. Emphasis is on analysis of non-Western languages and research techniques. 3 hours or 1/2 unit. KIM, CHENG.
302. **Comparative Linguistics.** An introduction to the historical aspects of language. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or 1/2 unit. ZGUSTA.
303. **Non-Western Linguistic Structures.** Intensive study of linguistic structure of a selected non-Western language. 3 hours or 1 unit. With consent of instructor, this course may be repeated for credit.
305. **Introduction to Applied Linguistics.** An introduction to the applications of general linguistic theory to the specific of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign and second languages; practical assignment work. Prerequisite: Consent of instructor. 3 hours or 3/4 unit. BOUTON, B. KACHRU
307. **Introduction to Mathematical Linguistics.** Same as Anthropology 307. Principles of set theory, logic and formal systems, group theory, and automata theory. Introduction to the formal theory of grammars. Prerequisite: Linguistics 300. 3 hours or 1 unit.

308. **Comparative Grammar of Greek and Latin.** Same as Greek and Latin 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or 1/2 unit.
309. **Introduction to Indo-European Linguistics.** Introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction; principles of comparative phonology and introductory survey of morphology; discussion of theories about the original home, culture, and society of the Indo-Europeans. Prerequisite: Fulfillment of the language requirement of the College of Liberal Arts and Sciences. 3 hours or 1 unit. HOCK, ZGUSTA.
310. **Topics in Indo-European Linguistics.** Principles of Indo-European morphology; paper and discussion on selected topics of Indo-European linguistics, such as phonology, morphology, migrations, and antiquities. Prerequisite: Linguistics 309 or equivalent. 3 hours or 1 unit. HOCK, ZGUSTA.
316. **Structure of the French Language.** Same as French 316. A general survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax. Emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or 3/4 unit. JENKINS.
317. **Languages of the World.** Same as Anthropology 317. A survey of the main language families of the world from both genetic and typological points of view, with special reference to the theory of syntactic descriptions. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or 1/2 or 1 unit.
320. **Introduction to African Linguistics.** Introduction to genetic and typological classification of the main language families of Africa; concentration on grammatical and phonological characteristics. Prerequisite: Linguistics 200 or 300; consent of instructor. 3 hours or 1 unit. STAHLKE.
325. **Introduction to Psycholinguistics.** Same as Communications 325. An introductory survey of psychological and linguistic approaches to the study of communication. Prerequisite: Credit or registration in Linguistics 300. 3 hours or 1 unit. MACLAY.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Korean 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; or consent of instructor. 3 hours or 1 unit. CHENG.
338. **Philosophies of Language.** Same as Philosophy 338. A study of the development of philosophical problems about language and the treatment of them from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
340. **History of Linguistics.** A survey of linguistic theories from ancient to modern times. Special emphasis is given to comparative grammar and the development of structural linguistics; there is an extended discussion of at least one other period. Prerequisite: Linguistics 300 or equivalent. 3 hours or 1 unit. ZGUSTA.
350. **Sociolinguistics.** A critical study of the sociologically oriented general linguistic theories with special reference to language varieties, language attitudes, language diversity, language standardization, linguistic geography, and language and political roles (language loyalty). Emphasis on research methodology and techniques. Concentration on South Asia. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or 1/2 or 1 unit. B. KACHRU.
360. **Introduction to South Asian Linguistics.** Introduction to genetic and typological classification of the main language families of South Asia; concentration on phonology and syntax. Prerequisite: Consent of instructor. 3 hours or 1 unit. Y. KACHRU.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or 1/2 unit.
367. **Introduction to Germanic Linguistics.** Same as Germanic 367. A comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign

language requirement in the College of Liberal Arts and Sciences, or equivalent. Some knowledge of German is desirable. 2 hours or 1/2 unit.

370. **Language, Culture, and Society.** Same as Anthropology and Communications 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, one course in communications or linguistics, or consent of instructor. 3 hours, or 1/2 or 1 unit. CASAGRANDE.
375. **Speech Science, I.** Same as Speech 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms and to fundamental acoustics of speech. Prerequisite: Speech 109 or 301, or consent of instructor. 4 hours or 1 unit. ZEMLIN.
376. **Speech Science, II.** Same as Speech 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Linguistics 375 or consent of instructor. 4 hours or 1 unit. ZEMLIN.
380. **Introduction to Slavic Linguistics.** Same as Slavic 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or 3/4 unit.
382. **Introduction to Sanskrit Linguistics, I.** The sounds and alphabet of Sanskrit; introduction to grammar, with drill and readings; sandhi rules. Reading: Nala and Damayanti. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit. HOCK.
383. **Introduction to Sanskrit Linguistics, II.** Further grammar and reading; consideration of Sanskrit from one or more of the following points of view: (a) comparative Indo-European linguistics, (b) Indology, (c) Paninian linguistics, (d) Western linguistic theories, (e) transformational-generative grammar. Prerequisite: Linguistics 382. 3 hours or 1 unit. HOCK.
388. **Linguistics in Language Learning, I.** Same as Rhetoric 388. The applications of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or 3/4 unit. ASTON.
389. **Linguistics in Language Learning, II.** Same as Rhetoric 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the application of some principles of psycholinguistics, sociolinguistics and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or 3/4 unit. ASTON.
401. **Syntax.** Critique of traditional and contemporary theories of syntactic structure; systematic introduction to transformational grammar. Prerequisite: Linguistics 300 or equivalent. 1 unit.
402. **Phonology.** Examination of language-specific phonological problems with a view toward formulating a language-independent theory of phonology. Prerequisite: Linguistics 301 or consent of instructor. 1 unit. KISSEBETH.
403. **Seminar in Linguistic Analysis.** Discussion of advanced topics of current interest in descriptive linguistics. Prerequisite: Linguistics 401. 1 unit. May be repeated for credit with consent of instructor. STAFF.
404. **Practicum.** Classroom- and homework-solving of assorted problems in syntactic and phonological analysis of many languages. Prerequisite: Linguistics 401 and 402. 1 unit.
405. **Seminar in Stylistics.** A seminar designed to evaluate and discuss earlier and current linguistically motivated stylistic theories; emphasis on the theoretical and methodological problems in application of linguistics to stylistic analysis of literary texts. Prerequisite: Linguistics 300 or 305; consent of instructor. 1 unit. B. KACHRU.
407. **Advanced Topics in Mathematical Linguistics.** The hierarchy of automata and the hierarchy of grammars; equivalence theorems and undecidability theorems; recognition procedures. Prerequisite: Linguistics 307 or equivalent. 1 unit.
408. **Russian Phonology.** Same as Russian 408. Synchronic examination of the phonological system of modern Russian and of its interrelation with the syntactic and lexical systems;

brief discussion of the historical development of the phonological system. Prerequisite: Consent of instructor. 1 unit.

411. **Methods in Historical Linguistics.** Advanced analysis of genetic comparison and reconstruction, linguistic borrowing, linguistic geography, etymology, and related topics. Prerequisite: Linguistics 302 or 315. 1 unit. HOCK, ZGUSTA.
412. **Research Seminar in Historical Linguistics.** Research work in etymology, linguistic geography, and historical syntax. Prerequisite: Linguistics 411 or consent of instructor. 1 unit. ZGUSTA.
419. **Contrastive Linguistics.** Same as Rhetoric 419. A critical survey of contemporary linguistic models with special reference to their relevance in preparing contrastive analyses of languages; detailed discussion on contrastive analysis of English and selected non-Western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. 1/2 or 1 unit. Y. KACHRU.
420. **Linguistic Phonetics.** Principles of scientific description of the phonic aspect of language; distinctive features and phonetic alphabets; relations between phonetics and other linguistic levels; and inventory of speech sounds. Prerequisite: Linguistics 301 or equivalent. 1 unit. KIM.
421. **Seminar in Phonetic Theories.** Theories of speech production; motor theory and linguistic change; acoustical correlates of vocal-tract configurations; theories of speech perception; and a model of universal phonetics. Prerequisite: Linguistics 301 or equivalent. 1 unit. KIM.
424. **Developmental Psycholinguistics.** Same as Communications and Psychology 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Communications and Psychology 425. A critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic, information-theory and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit. OSGOOD.
426. **Research Seminar in Psycholinguistics.** Same as Communications and Psychology 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course are expected to plan, execute, and report an original piece of research in this area during the course. Prerequisite: Linguistics 425; consent of instructor. 1/2 or 1 unit. MACLAY, OSGOOD.
429. **Second Language Acquisition and Bilingualism.** Same as Psychology 429. An examination of the field from a psycholinguistic perspective. The following topics are discussed: first vs. second language acquisition, the nature of language aptitude and competence, methods of second language teaching, the nature of bilingualism, and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit. JAKOBOVITS.
441. **Syntax, II.** Advanced analysis and critique of syntactic descriptions, with special attention to implications for universal grammar. Prerequisite: Linguistics 401 or consent of instructor. 1 unit. GREEN, MORGAN.
450. **Linguistics and the Study of Meaning.** A consideration of those aspects of meaning which are the concern of linguistic theory. Prerequisite: Linguistics 300. 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Linguistics 362 or consent of instructor. 1 unit.
475. **Experimental Phonetics, I.** Same as Speech 475. Theoretical consideration of speech as motor behavior, with special reference to physiological investigations of normal respiration, phonation, and articulation. Survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit. ZEMLIN.
476. **Experimental Phonetics, II.** Same as Speech 476. Theoretical consideration of speech as an acoustical phenomenon, with special reference to acoustical investigations of voice

and speech sounds. Survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit. ZEMLIN.

477. **Measurement of Speech, I.** Same as Speech 477. Principles and methods of measuring speech action. Special action recorders and transducers; techniques of analysis; problems of experimental design. Laboratory experimentation. Prerequisite: Consent of instructor; credit or registration in Linguistics 475. 1 unit. ZEMLIN.
478. **Measurement of Speech, II.** Same as Speech 478. Principles and methods of measuring the acoustical phenomena of speech. Oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design. Laboratory experimentation. Prerequisite: Consent of instructor; credit or registration in Linguistics 476. 1 unit. ZEMLIN.
481. **Topics in Syntactic Theory.** Investigation of syntactic universals; recent developments in the theory of syntax. Prerequisite: Linguistics 317, 387, or 401; consent of instructor. 1 unit. MORGAN.
482. **Topics in Phonological Theory.** Continuation of Linguistics 402. Special topics and individual papers are assigned. Prerequisite: Linguistics 402 or equivalent. 1 unit. KISSEBERTH.
490. **Special Topics in Linguistics.** Individual studies in the areas of linguistics not covered by regular course offerings. 1/2 to 2 units.
499. **Thesis Research.** 0 to 4 units.

Arabic

201. **Elementary Arabic, I.** An introduction to Arabic in one of its standard national forms, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Arabic, II.** Second term of spoken Arabic, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 201. 5 hours.
203. **Elementary Spoken Arabic, I.** An introduction to spoken Arabic in one of its standard dialects, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar. 5 hours.
204. **Elementary Spoken Arabic, II.** Continuation of Arabic 203, with introduction of more advanced grammar and with an emphasis on achieving more fluency in spoken Arabic. Prerequisite: Arabic 203. 5 hours.
303. **Intermediate Arabic, I.** First term of second year of the Arabic language, with drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Arabic, II.** Concentration on ability to engage in reasonably fluent discourse in Arabic, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Arabic, I.** Reading selections from literary works; selections from political, social, historical, and economic writings. Prerequisite: Arabic 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Arabic, II.** Continuation of Arabic 305. Further reading in literary sources as well as in history, economics, and politics. Prerequisite: Arabic 305 or equivalent. 5 hours or 1 unit.

307. **Introduction to Arabic Literature, I.** Select readings in Arabic literature with emphasis on the novel and short story. The course includes lectures and discussions on the theory of literature and Arabic aesthetics. Prerequisite: Arabic 304. 3 hours or 1 unit.
308. **Introduction to Arabic Literature, II.** Select readings in Arabic literature with emphasis on poetry and plays. The course includes lectures and discussions on the theory of literature and Arabic aesthetics. Prerequisite: Arabic 304. 3 hours or 1 unit.

Hindi

201. **Elementary Hindi, I.** An introduction to Hindi, including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. BHATIA, SUBBARAO.
202. **Elementary Hindi, II.** Second term of spoken Hindi, including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 201. 5 hours. SUBBARAO.
303. **Intermediate Hindi, I.** First term of second year of the Hindi language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 202 or equivalent. 5 hours or 1 unit. SUBBARAO.
304. **Intermediate Hindi, II.** Concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 303 or equivalent. 5 hours or 1 unit. SUBBARAO.
305. **Advanced Hindi, I.** A course for advanced knowledge of spoken and written Hindi. All students are required to work at least one hour each week with a native informant and/or on the language laboratory. 5 hours or 1 unit. Y. KACHRU.
306. **Advanced Hindi, II.** A course for advanced knowledge of spoken and written Hindi with emphasis on modern Hindi literature and language. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. 5 hours or 1 unit. Y. KACHRU.
307. **Advanced Hindi, III.** A course for detailed analysis of formal grammar of Hindi with concentration on readings from Hindi literature. Prerequisite: Hindi 306 or consent of instructor. 5 hours or 1 unit.
308. **Advanced Hindi, IV.** A survey of the history of Hindi literature and readings from different periods of Hindi literature. Prerequisite: Hindi 307 or consent of instructor. 5 hours or 1 unit.
309. **Readings in Hindi Literature in Translation.** Introduction to Hindi literature since 1400 A.D. Concentration on major works in poetry and prose available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit. Y. KACHRU.
310. **Readings in Hindi Literature in English Translation.** Introduction to Hindi literature—Modern Period. Concentration on major works in poetry, prose, and novel available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit. Y. KACHRU.
345. **Tutorials in Special Asian Languages.** Same as Asian Studies 345. Tutorials at the elementary, intermediate, and advanced levels in special Asian languages not regularly offered are available with the consent of the Director of the Center for Asian Studies. May be repeated up to six semesters successively, but no more than four units of graduate credit may be accumulated. Graduate credit is given only for work beyond the elementa-

ry level. Prerequisite: Consent of Director of the Center for Asian Studies. 5 hours or 1 unit.

Modern Greek

201. **Elementary Modern Greek, I.** An introduction to Modern Greek, in its spoken and written forms, including the elements of formal grammar. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. PAPANIKOLAOU.
202. **Elementary Modern Greek, II.** Second term of spoken Modern Greek, formal grammar based on graded lesson materials, and work in written Greek. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. PAPANIKOLAOU.
303. **Intermediate Modern Greek, I.** First term of second year of work in Modern Greek, with drill for more advanced conversational fluency, introduction to a greater variety of styles and levels of discourse and usage, increasing study of the written language, and more formal grammar. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 202 or equivalent. 5 hours or 1 unit. PAPANIKOLAOU.
304. **Intermediate Modern Greek, II.** Continuation of Modern Greek 303. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 303 or equivalent. 5 hours or 1 unit. PAPANIKOLAOU.

Modern Hebrew

201. **Elementary Modern Hebrew, I.** Introduction to Hebrew, including conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. Students are required to register for one hour weekly in the language laboratory. 5 hours. BOLOZKY.
202. **Elementary Modern Hebrew, II.** Continuation of Modern Hebrew 201, with introduction of more advanced grammar, and with emphasis on more fluency in speaking and reading. Prerequisite: Modern Hebrew 201. 5 hours. BOLOZKY.
303. **Intermediate Modern Hebrew, I.** First term of the second year of the Hebrew language, including drill for more advanced conversational fluency; increased study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 202 or equivalent. 5 hours or 1 unit. BOLOZKY.
304. **Intermediate Modern Hebrew, II.** Concentration on ability to engage in reasonable fluent discourse in Hebrew; comprehensive knowledge of formal grammar and an ability to read ordinary written Hebrew. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 303 or equivalent. 5 hours or 1 unit. BOLOZKY.
305. **Advanced Modern Hebrew, I.** A course for advanced knowledge of spoken and written standard Modern Hebrew. Prerequisite: Modern Hebrew 304 or equivalent. 5 hours or 1 unit. BOLOZKY.
306. **Advanced Modern Hebrew, II.** A course for advanced knowledge of spoken and written standard Modern Hebrew with emphasis on Modern Hebrew literature and language. Prerequisite: Modern Hebrew 305 or equivalent. 5 hours or 1 unit. BOLOZKY.
307. **Advanced Modern Hebrew, III.** Selected readings from modern Hebrew authors, with emphasis on the novel and short story. Lectures and discussions on Hebrew literature and aesthetics and detailed analysis of the formal grammar of Hebrew. Prerequisite: Modern Hebrew 306 or consent of instructor. 5 hours or 1 unit. BOLOZKY.

308. **Advanced Modern Hebrew, IV.** Selected readings from modern Hebrew authors, with special emphasis on the East European "Revival" literature. Lectures and discussions on Hebrew literature and aesthetics, and detailed analysis of formal grammar of Hebrew. Prerequisite: Modern Hebrew 307 or consent of instructor. 5 hours or 1 unit. BOLOZKY.

Swahili

201. **Elementary Swahili, I.** Same as African Studies 201. Beginning spoken Swahili with minimum of formal grammar. Conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.
202. **Elementary Swahili, II.** Same as African Studies 202. Second semester of spoken Swahili. More conversation with a native tutor. Further grammar. Prerequisite: Swahili 201. 5 hours.
303. **Intermediate Swahili, I.** Same as African Studies 303. Second-year Swahili with emphasis on developing conversational fluency. Some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as African Studies 304. More of second-year Swahili with emphasis on conversational fluency. Some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.

Yoruba

201. **Elementary Yoruba, I.** Same as African Studies 205. An introduction to Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor, and essentials of formal grammar. All students are required to register for 3 hours per week in the language laboratory. 5 hours. STAHLKE.
202. **Elementary Yoruba, II.** Same as African Studies 206. Second term of spoken Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor. Further formal grammar based on conversational materials. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: Yoruba 201 or consent of instructor. 5 hours. STAHLKE.
303. **Intermediate Yoruba, I.** Same as African Studies 307. Continued study of Yoruba grammar with emphasis on developing conversational fluency; readings on Yoruba culture and current affairs. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: Yoruba 202 or consent of instructor. 5 hours or 1 unit. STAHLKE.
304. **Intermediate Yoruba, II.** Same as African Studies 308. Concentrates on attaining conversational fluency. Further readings in Yoruba newspapers and magazines and simpler portions from contemporary Yoruba plays and novels. All students are required to register for 3 hours per week in the language laboratory. Prerequisite: Yoruba 303 or consent of instructor. 5 hours or 1 unit. STAHLKE.

MATHEMATICS

Head of Department: Professor P. T. BATEMAN
Department Office: 273 Altgeld Hall

MAJOR IN MATHEMATICS

Major: The equivalent of Mathematics 140, or 141 or 145, plus eighteen hours of mathematics courses with numbers greater than 290, of which at least twelve hours must be

in courses chosen from Mathematics 314, 317, 318, 323, 324, 327, 328, 332, 342, 347, 348, 349, 352, 353, 354, 361, 364, 366, 387, 392. For students preparing for graduate study in mathematics, the following courses are recommended: Mathematics 317, 318, 332, 347, 348. Students in special curricula and those who do not intend to pursue mathematics professionally should consult with their advisers.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: accountancy, astronomy, chemistry, computer science, economics, finance, philosophy, physics, psychology, statistics (Mathematics 161, 361, 362, 363, 364, 375), surveying, theoretical and applied mechanics.

Departmental Honors: Entering students with superior mathematical ability should apply to the Department of Mathematics, 273 Altgeld Hall, for information regarding the honors course, Mathematics 149.

Information regarding requirements for graduation with distinction in mathematics is available from the Advising Office, 269 Altgeld Hall.

Note: An entering student with adequate preparation in high school mathematics should enroll in Mathematics 120 during the first semester and in Mathematics 130 or 131 during the second semester of his freshman year. Admission to Mathematics 120 normally requires a passing grade on the mathematics placement test. A student ineligible for Mathematics 120 should enroll in algebra (Mathematics 111 or 112) and trigonometry (Mathematics 114) during his first semester.

Students in special curricula and those who intend to terminate their study of mathematics with the bachelor's degree should consult their advisers regarding other selections from the above list of required courses that would relate to their special interests.

MAJOR IN ACTUARIAL SCIENCE

Major: The equivalent of Mathematics 140, or 141, or 145, and eighteen hours chosen from Mathematics 310, 311, 343, 361, 362, 363, 371, 372, and Computer Science 101. At least twelve hours must be chosen from Mathematics 310, 361, 362, 363, 371, 372.

Minor: Twenty hours of finance including the sequence Finance 260, 262, 360, 363, or the sequence Finance 260, 262, 370, 371.

Note: Students are urged to elect Accountancy 201 and Business Administration 261 during the junior or senior year.

MAJOR IN MATHEMATICS AND COMPUTER SCIENCE

Note: This major is offered by the Department of Mathematics under the curriculum in science and letters for students of mathematics who have a special interest in the use of computers. Further details are given under the listing of courses of the Department of Computer Science.

MAJOR IN STATISTICS

Major: The equivalent of Mathematics 140, 141, or 145, plus eighteen hours of mathematics courses with numbers greater than 290 including the following specific courses: 315 or 318, 347, 363, 364.

Minors: Twenty hours in one subject approved by the Department of Mathematics. Of these twenty hours not more than nine may be in statistical methods, and Mathematics 161 may be taken as three of these hours. The courses not emphasizing statistical methods should be chosen so that courses on the 400 level can be taken if the student enters the Graduate College.

101. Basic Mathematics. An introduction to algebra, designed for the Special Educational Opportunities Program. Topics in arithmetic, measurement, and elementary geometry and algebra. 4 hours.

104. Elements of Algebra and Trigonometry. For premedical students and students in the curriculum preparatory to the teaching of biology who have entered with only one unit

of high school algebra and who need credit in trigonometry as a prerequisite to physics. Such students who enter with one and one-half units of algebra must take Mathematics 114. This course does not serve as a prerequisite for Mathematics 122 or 123. Credit in Mathematics 104 involves duplication of credit with Mathematics 111, 114, and 118. Prerequisite: High school algebra, 1 unit; plane geometry, 1 unit. 3 hours.

111. **Algebra.** Students having 1 1/2 or more units of high school algebra may not take this course unless they have the approval of their college office. Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, 1 unit; plane geometry, 1 unit. 5 hours.
112. **College Algebra.** Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, 1 1/2 units; plane geometry, 1 unit. 3 hours.
114. **Plane Trigonometry.** Prerequisite: Entrance algebra, 1 1/2 units, or registration in Mathematics 111; plane geometry, 1 unit. 2 hours.
118. **Introduction to Mathematics.** An elementary course for students whose major interests are not in engineering or the physical sciences. Provides an overall view of mathematics; emphasizes ideas and concepts rather than routine drill. Surveys the following topics: evolution of the number system, understanding rules for algebraic manipulation, logic and set theory, probability and statistics, trigonometry, analytic geometry, differential and integral calculus, calculus, transfinite numbers, group theory, non-Euclidean geometry, impossibilities and unsolved problems. Credit in Mathematics 118 involves duplication of credit with Mathematics 104, 111, 112, 114, and 124. Prerequisite: Algebra, 1 unit; plane geometry, 1 unit, or equivalent. 4 hours.
119. **Introduction to Mathematics.** Continuation of Mathematics 118. Prerequisite: Mathematics 118. 4 hours.
120. **Calculus and Analytic Geometry.** First course in calculus and analytic geometry. Basic techniques of differentiation and integration with applications, including curve tracing in the plane. Students with strong backgrounds in analytic geometry should normally enroll in Mathematics 135. Credit is not granted for Mathematics 120 or 135 and Mathematics 134. Prerequisite: Mathematics 111 or 112, and Mathematics 114, or an adequate placement test score. 5 hours.
124. **Introductory Analysis for Social Scientists:** An introduction to finite mathematics for students in the social sciences. Introduces the student to the basic ideas of logic, set theory, and vectors and matrices with problems selected from the fields of social science and business. Prerequisite: Mathematics 111 or 112, or a passing grade on the Mathematics Placement Test. 3 hours.
130. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections, polar coordinates; parametric equations; vectors, partial derivatives; first order differential equations. Prerequisite: Mathematics 120. 5 hours.
131. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections, polar coordinates; vectors. Prerequisite: Mathematics 120. 3 hours.
134. **Introductory Analysis for Social Scientists.** Introduces the concepts of functions and relations and the basic ideas of the calculus. Credit is not granted for both Mathematics 134 and Mathematics 120 (or 135). Prerequisite: Mathematics 124. 4 hours.
135. **Calculus.** First course in calculus. Differentiation and integration; applications to curve-tracing, maxima and minima, area, volume. Prerequisite: Completion of a thorough college-level course in plane and solid analytic geometry, or equivalent. 5 hours.
140. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Multiple integrals; infinite series, linear algebra; linear differential equations. Prerequisite: Mathematics 130. 3 hours.
141. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Parametric equations, partial derivatives, multiple integrals, infinite series, linear algebra, first order and linear differential equations. Prerequisite: Mathematics 131. 5 hours.

145. **Calculus.** Second course in calculus. Further applications of derivatives and integrals; partial derivatives, vectors; multiple integrals; infinite series; first order and linear differential equations. Prerequisite: Mathematics 135. 5 hours.
149. **Honors Course in Mathematics.** Prerequisite: Registration in an honors section of Mathematics 120, 130, 131, 140, or 141; consent of the department. Enrollment is strictly limited to students with superior mathematical talents. 1 hour.
161. **Statistics.** Credit is not given for Mathematics 161 in addition to Economics 171 or Psychology 135. Prerequisite: Mathematics 111 or 112; sophomore standing. 3 hours.
198. **Freshman Seminar.** The seminar guides the student in the study of selected topics not considered in standard courses. Prerequisite: Enrollment in the mathematics honors program; consent of department. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
202. **Mathematics for Elementary Teachers.** A systematic presentation of elementary mathematics for juniors and seniors who are preparing to teach in elementary schools. Topics include decimal numerals, number systems, sets, and introductory algebra. A simultaneous development of teaching methods and materials may be included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Junior standing in elementary education. 5 hours.
203. **Mathematics for Elementary Teachers.** Continuation of Mathematics 202. Topics include measurement, metric and nonmetric geometry, algebra, sets, and introduction to trigonometry, statistics, and probability. A simultaneous development of teaching methods and materials is also included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Mathematics 202 or consent of instructor. 3 hours.
249. **Honors Course in Mathematics.** Prerequisite: Registration is designated honors sections of certain advanced undergraduate mathematics courses. 1 hour.
263. **Statistics in Engineering and the Physical Sciences.** A first course in the use of statistical methods for interpreting the results of experiments. Applications to engineering and the physical sciences are emphasized. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours.
287. **Introduction to Numerical Analysis.** Same as Computer Science 287. Presents basic, introductory material and concepts. Topics include computer representation of numbers; error analysis; iterative, methods; solution of linear equations. The computer is used extensively. A project is assigned. Prerequisite: Computer Science 101 or 121, one year of calculus, or consent of instructor. 3 hours.
291. **Thesis and Reading Course.** Prerequisite: Mathematics 347 with grade of "B" or better, or consent of Mathematics Honors Committee. 2 hours.
292. **Thesis and Reading Course.** Prerequisite: Mathematics 347 with grade of "B" or better, or consent of Mathematics Honors Committee. 2 hours.
299. **Intermediate Seminar.** This course guides the student to construct a coherent mathematical system by solution of nonroutine problems. The subject matter varies with the instructor. Prerequisite: Enrollment in mathematics honors program; consent of department. 3 hours.
300. **The Theory of Sets and the Real Number System.** This course deals with elementary naive set theory and the development of the integers, the rational numbers, and the real numbers. The principal emphasis is upon the mathematical needs of the secondary school teacher. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
301. **Fundamental Concepts of Algebra.** Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
302. **Topics on Geometry.** Historical development of geometry including tacit assumptions made by Euclid, Euclid's Fifth Postulate and its equivalents, and the discovery of non-Euclidean geometries, geometry as a mathematical structure, finite geometries, geometry as a study of invariants of set transformations, projective geometry, applications of group theory to geometry, vector geometry. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

303. **Advanced Aspects of Euclidean Geometry.** Selected topics from geometry as, for example, circum-circle, the nine-point circle, theorems on centroid and ortho-center, the construction of regular figures, isometrics in the plane and space, rotations and translations, fixed points, ordered and affine geometries, and geometry of inversive plane. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
305. **Teachers Course.** A study of some special teaching problems in arithmetic, algebra, geometry, and trigonometry. Teaching procedures for important topics in these subjects are discussed in relation to their foundations in mathematics and logic. Topics suitable for presentation for superior high school students are considered. Prerequisite: Mathematics, 140, 141, or 145, or equivalent, or consent of instructor. 3 hours, or 1/2 or 1 unit.
306. **Selected Mathematical Topics for Secondary School Teachers, I.** This course deals with the teaching of the following topics in secondary school mathematics symbolism and numbers; variables; equations (linear, quadratic systems); sets, graphs, bases of enumeration; functions; critical examination of these topics. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or 1/2 or 1 unit.
307. **Selected Mathematical Topics for Secondary School Teachers, II.** This course deals with the teaching of the following topics in high school mathematics: variables in geometry; logical analysis of geometrical propositions; equivalence relations in geometry including congruence and similarity; geometry in the coordinate plane; cosine and sine as real valued functions of real arguments; a comparison of these functions with those ordinarily taught in the high school; symmetry; periodicity; evenness and oddness; exponential and logarithmic functions. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or 1/2 or 1 unit.
310. **Theory of Interest.** A study of compound interest, annuities, and applications to problems in finance. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
311. **Advanced Algebra.** For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or consent of instructor. 3 hours or 1 unit.
312. **Advanced Algebra.** For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
313. **Combinatorial Mathematics.** Same as Computer Science 313. Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, block designs. Prerequisite: Math 140, 141, or 145, or equivalent. 3 hours or 1 unit.
314. **Introduction to Set Theory and Mathematical Logic.** In general, this course supplies the set-theoretic and logical preliminaries for graduate work in mathematics. Contents: sets, relations, and mappings; the notions of constant and variable; the integers; cardinal and ordinal numbers; Zorn's Lemma; the real numbers; informal account of the propositional calculus and first order functional calculus; informal account of various axiomatic theories. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
315. **Linear Transformations and Matrices.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
317. **Introduction to Abstract Algebra.** An introductory course in abstract algebra, including modular arithmetic, permutations, group theory through the isomorphism theorems, ring theory through the notions of prime and maximal ideals, and additional topics such as unique factorization domains and classification of groups of small order. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
318. **Introduction to Linear Algebra.** Abstract approach, emphasizing concept of linear transformation. Topics covered: linear equations, vector spaces, linear transformation, matrices, determinants, invariant subspaces, direct sum decompositions, canonical

forms, inner product spaces, bilinear forms. Prerequisite: Mathematics 317. 3 hours or 1 unit.

319. **Applied Modern Algebra.** Sets and functions, binary relations and graphs, applications to finite state machines and formal languages, Boolean algebras. Emphasis is on the underlying mathematical structure. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
323. **The Elements of Geometry and Topology, I.** Introduction to geometrical techniques relevant to topology and differential geometry. Curves from four viewpoints: topology, differential geometry, combinatorics, and algebraic geometry. Local differential geometry of surfaces. Prerequisite: Mathematics 343. 3 hours or 1 unit.
324. **The Elements of Geometry and Topology, II.** Continuation of Mathematics 323. Three viewpoints of surfaces are studied and interrelated: topology, differential geometry, and combinatorics (algebraic topology). Prerequisite: Mathematics 323. 3 hours or 1 unit.
327. **Introduction to Projective Geometry, I.** Prerequisite: One year of calculus. 3 hours or 1 unit.
332. **Introduction to Set Theory and Topology.** Informal set theory, cardinal and ordinal numbers, axiom of choice. Topology of metric spaces and introduction to general topological spaces. Prerequisite: Credit or registration in Mathematics 347. 3 hours or 1 unit.
341. **Differential Equations.** A basic course in ordinary differential equations. Topics include existence and uniqueness of solutions and the general theory of linear differential equations. The treatment is more rigorous than that given in Mathematics 345 but not as rigorous as that given in Mathematics 349. Credit is not given for both Mathematics 341 and 345 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
342. **Differential Equations.** This course deals with the theory of Fourier series and applications to solving partial differential equations. Prerequisite: Mathematics 341 or 349. 3 hours or 1 unit.
343. **Advanced Calculus.** Introductory study of vector calculus and functions of several variables. Topics include directional derivatives, Jacobians, change of variables in multiple integrals, maxima and minima, line and surface integrals, theorems of Gauss, Green and Stokes, infinite series, uniform convergence. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
345. **Differential Equations and Orthogonal Functions.** This course is primarily intended for engineering students and others who require a working knowledge of differential equations. Credit is not given for both Mathematics 345 and 341 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
346. **Complex Variables and Applications.** For students who desire a working knowledge of complex variables. Covers the standard topics and in addition gives an introduction to integration by residues, the argument principle, conformal maps, Laplace transforms, and potential fields. Students desiring a systematic development of the foundations of the subject should take Mathematics 348. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.
347. **Introduction to Higher Analysis: Real Variables.** A careful development of elementary real analysis including such topics as completeness property of the real number system, basic topological properties of n -dimensional space, convergence of numerical sequences and series of functions, properties of continuous functions, basic theorems concerning differentiation and Riemann integration. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.
348. **Introduction to Higher Analysis: Complex Variables.** For students who desire a rigorous introduction to the theory of functions of a complex variable. Topics include Cauchy's Theorem, the Residue Theorem, the Maximum Modulus Theorem, Laurent series, the Fundamental Theorem of Algebra, and the argument principle. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 347. 3 hours or 1 unit.

349. **Differential Equations and Orthogonal Functions.** An honors course that presents a more rigorous treatment of the subject than that given in Mathematics 341 and 345. Credit is not given for both Mathematics 349 and 341, or 345. Prerequisite: A grade of "B" or higher in Mathematics 347; and, for undergraduates, registration in Mathematics 249. 3 hours or 1 unit.
350. **Topics in Pure Mathematics.** This is a survey course in pure mathematics for secondary school mathematics teachers. It deals with topics in number theory, topology, and analysis. Prerequisite: Consent of instructor. 3 hours or 1 unit.
351. **Topics in Applied Mathematics.** A survey course in applied mathematics for secondary school mathematics teachers. It deals with topics in the application of matrices to physical and social sciences, applications of Boolean algebra and game theory. Prerequisite: Consent of instructor. 3 hours or 1 unit.
352. **Multivariate Real Analysis.** Rigorous treatment of the calculus of functions of several real variables. Topics covered include differentials, maxima and minima, Lagrange multipliers, transformation of multiple integrals, Jacobians, implicit function theorems, line and surface integrals, Stokes' theorem, vector analysis. Prerequisite: Mathematics 347. 3 hours or 1 unit.
353. **Elementary Theory of Numbers.** Topics covered include divisibility, primes, congruences, quadratic reciprocity, and Farey sequences. The course objectives are to familiarize students with mathematical proofs and to prepare them for further work in algebra and number theory. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
354. **Theory of Algebraic Numbers.** Topics include Gaussian integers and primes, polynomials, divisibility, algebraic integers, arithmetic in algebraic number fields, ideals, class numbers, and units. Prerequisite: Mathematics 317 or 353. 3 hours or 1 unit.
357. **Mathematical Models in the Social Sciences.** Uses many models drawn from the social sciences to motivate, illustrate, and give a unified development of topics in the following areas: linear algebra, graph theory, Markov chains, and linear and nonlinear systems of difference equations. Prerequisite: Mathematics 134 or equivalent. 3 hours or 1 unit.
361. **Theory of Probability.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
362. **Finite Differences.** Finite differences, finite integration, interpolation, difference equations. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
363. **Advanced Statistics.** Probability and statistical inference. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
364. **Advanced Statistics.** Continuation of Mathematics 363. Prerequisite: Mathematics 363. 3 hours or 1 unit.
365. **Analysis of Variance.** Estimation and hypotheses testing in linear models; one-, two-, and higher-way layouts; incomplete layouts; analysis of covariance; random effects models and mixed models. Prerequisite: Credit or registration in Mathematics 315 and 364. 3 hours or 1 unit.
366. **Theory of Probability.** Continuation of Mathematics 361. Topics covered may include random walks, Markov chains, branching processes, birth and death processes, and theory of queues. Prerequisite: Mathematics 361 or 363. 3 hours or 1 unit.
367. **Computer Application to Problems in Mathematics.** Same as Computer Science 367. Discusses many problems which can be formulated mathematically and lend themselves to computer solution. Problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; game playing and decision problems. Prerequisite: Computer Science 101, 107, 121, or equivalent; junior standing or consent of instructor. 3 hours or 1 unit.
368. **Topics in Applied Statistics.** Formulation and analysis of mathematical models for random phenomena; student participation in statistical consulting; instruction in statistical techniques as required. Prerequisite: Mathematics 363 or consent of instructor. 3 hours or 1 unit. May be taken for credit more than once with consent of instructor.

- 369. Probability Theory.** This course qualifies the student to study Mathematics 370 and subsequently the graduate courses in mathematical statistics. Starting from first principles, it covers, among other things, characteristic functions, laws of large numbers, central limit theorems, and strong convergence. No measure theory is needed or used in this course. Prerequisite: Mathematics 347. 3 hours or 1 unit.
- 370. Statistical Inference.** This is the basic course in mathematical statistics and is prerequisite to all graduate courses on the subject. It starts from the first principles and examines critically the bases of statistical inference. Although it is not a course in statistical techniques, graduates of the course will be able to read the literature of statistical techniques. Prerequisite: Mathematics 369 or 451. 3 hours or 1 unit.
- 371. Actuarial Theory.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
- 372. Actuarial Theory.** Prerequisite: Mathematics 371. 3 hours or 1 unit.
- 375. Automatic and Formal Languages, I.** Same as Computer Science 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; the Post correspondence problem and its application to context free languages. Prerequisite: Computer Science 319 or consent of instructor. 3 hours or 1 unit.
- 376. Automatic and Formal Languages, II.** Continuation of Mathematics 375. Context sensitive languages and linear bounded automata; operations on languages, closure properties, abstract families of languages; miscellaneous unsolvable problems; time and tape bounded Turing machines; other topics chosen by the instructor. Prerequisite: Mathematics 375. 3 hours or 1 unit.
- 381. Vector and Tensor Analysis.** Prerequisite: Mathematics 343 or equivalent, or consent of instructor. 3 hours or 1 unit.
- 382. Vector, Tensor, and Matrix Methods in Applied Mathematics.** Prerequisite: Mathematics 381 or consent of instructor. 3 hours or 1 unit.
- 383. Linear Programming.** Same as Computer Science 383. Systems of linear inequalities, the standard canonical and general linear problems, simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
- 386. Laplace Transforms.** Basic operation rules of Laplace transforms through the complex-inversion theorem. Applications to solutions of initial and boundary value problems in differential equations, and evaluation of Cauchy integrals. Other types of transforms are considered and used for solving differential equations. Prerequisite: Mathematics 343. 3 hours or 1 unit.
- 387. Numerical Analysis.** Same as Computer Science 387. Error analysis and algorithms for: the solution of equations; the computation of eigenvalues and eigenvectors; numerical quadrature; numerical approximation of functions. Prerequisite: Computer Science 287, a knowledge of elementary matrix algebra, or consent of instructor. 3 hours or 1 unit.
- 388. Mathematical Methods in Engineering and Science.** Prerequisite: Mathematics 343. 3 hours or 1 unit.
- 389. Combinatorial Computing.** Same as Computer Science 389. Computational aspects of algorithms for solving combinatorial problems. Topics include counting and enumeration, sorting, searching, computational problems in graph theory and algebra. Prerequisite: Computer Science 121 or equivalent; Mathematics 315 or equivalent, or consent of instructor.
- 390. Introduction to Optimization.** Same as Electrical Engineering 390. Basic theory and methods for the solution of optimization problems. Iterative techniques for unconstrained minimization. Introductory presentation of linear and non-linear programming with engineering applications. Prerequisite: Computer Science 101, Mathematics 343, or consent of instructor. 3 hours or 1 unit.
- 391. Switching Theory.** Same as Computer Science and Electrical Engineering 391. Combinational electronic and relay switching networks. Two-level design methods. Pulse-mode

- and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Introduction to Automata Theory.** Same as Computer Science and Electrical Engineering 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Mathematics 391 or consent of instructor. 3 hours, or 1/2 or 1 unit.
400. **General Seminar.** General seminar required of all graduate students who have passed the departmental written qualifying examination for the Ph.D. 0 credit.
401. **Second Course in Abstract Algebra, I.** Isomorphism theorems for groups; solvability of p -groups; simplicity of A_5 ; Sylow theorems, Jordan-Holder theorem; principal ideal domains; Gauss' lemma; Eisenstein's criterion; fundamental theorem of Galois theory; finite fields; cyclotomic fields; solvability of equations by radicals. Prerequisite: Mathematics 317 and 318. 1 unit.
402. **Second Course in Abstract Algebra, II.** Modules; Hilbert basis theorem; Krull-Schmidt theorem; Wedderburn theorem on semisimple rings; finitely generated modules over principal ideal domains, with applications to abelian groups and canonical forms for matrices; categories and functors; tensor products; bilinear and quadratic forms. Prerequisite: Mathematics 401. 1 unit.
403. **Theory of Rings.** Ideal theory in commutative rings; structure of noncommutative rings. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
404. **Group Theory.** Structure of groups, derived groups, nilpotence and solvability, extensions and products. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
405. **Algebraic Number Theory.** Further development of the theory of fields covering topics from valuation theory, ideal theory, units in algebraic number fields, ramification, function fields, local class field theory. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
406. **Homological Algebra.** Definition and properties of the functors Ext and Tor ; projective, injective, and flat modules; group extensions; dimensions of rings, Hilbert theorem on syzygies. Prerequisite: Mathematics 402 or equivalent. 1 unit.
407. **Group Representation Theory.** Representation of groups by linear transformations, group algebras, character theory, modular representations. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
408. **Lie Algebras.** Examples of Lie algebras (low dimensions, Lie algebras of Lie groups, free algebras, universal enveloping algebra), Poincaré-Birkhoff-Witt theorem, nilpotent and solvable algebras, Cartan subalgebras, structure of semi-simple algebras, real forms, representations. Prerequisite: Mathematics 401; credit or registration in Mathematics 402. 1 unit.
410. **Logical Foundations of Mathematics, I.** Develops the predicate calculus of first order as a framework for metamathematical investigations. Considers the elementary aspects of model theory; the completeness and compactness theorems, Lowenheim-Skolem theorem, Craig interpolation theorem, elementary facts about ultraproducts. Prerequisite: Mathematics 314, or 317, or 341, or Philosophy 333, or consent of instructor. 1 unit.
411. **Logical Foundations of Mathematics, II.** Axiomatic number theory and the incompleteness results of Gödel, Rosser and Tarski, Church's Theorem, and the elements of undecidability theory. Further topics selected by the instructor. Prerequisite: Mathematics 410. 1 unit.
412. **Recursive Function Theory.** Introductions to recursive functions, study of properties of recursive and recursively enumerable sets, degrees of unsolvability, and the implications of the Church-Turing thesis. Prerequisite: Mathematics 410 or consent of instructor. 1 unit.
413. **Set Theory.** Zermelo-Fraenkel axiomatic set theory; basic concepts in set theory such as ordinal, cardinal, and rank are considered. Prerequisite: Mathematics 410. 1 unit.
415. **Advanced Topics in the Theory of Groups.** Prerequisite: Consent of instructor. 1 unit.

416. **Advanced Topics in Abstract Algebra.** Prerequisite: Consent of instructor. 1 unit.
417. **Category Theory.** Categorical structure of mathematics. Categories, functors, and natural transformations. Limits, representable functors and functor categories. Adjoint functor theorems and Kan extensions. Algebraic theories and tripleable categories. Numerous examples from algebra, topology, and analysis. Prerequisite: Credit or registration in Mathematics 402 and 435. 1 unit.
418. **Graph Theory.** Structure of graphs, planarity and colorability of graphs, matrices associated with a graph, automorphism group of a graph. Prerequisite: Mathematics 313, 317, or 319, or equivalent. 1 unit.
422. **Algebraic Geometry.** Prerequisite: Mathematics 328. 1 unit.
423. **Differentiable Manifolds.** Definition and properties of differentiable manifolds and maps, introducing vector fields, tangent bundles, differential forms, exterior derivatives, foliations. Prerequisite: Mathematics 323 or 381, or consent of instructor. 1 unit.
424. **Riemannian Geometry.** Local and global properties of Riemannian manifolds. Prerequisite: Mathematics 423. 1 unit.
425. **Linear Analysis on Manifolds, I.** Study of topological invariants of differentiable and complex manifolds. Prerequisite: Mathematics 423 and 431, or consent of instructor. 1 unit.
426. **Linear Analysis on Manifolds, II.** Continuation of Mathematics 425. Prerequisite: Mathematics 425. 1 unit.
427. **Lie Groups.** Study of groups which are also differentiable manifolds. Prerequisite: Mathematics 423. 1 unit.
428. **Topics in Geometry.** Prerequisite: Consent of instructor. 1 unit.
430. **Elementary Geometry from a Modern Viewpoint.** Designed for secondary school teachers of mathematics. Primary purpose of the course is to discuss critically the logical structure and content of Euclidean geometry from the modern point of view. Consideration is given to the historical development of the modern approach. Prerequisite: One year of experience in the teaching of high school mathematics; consent of instructor. 1 unit.
431. **Algebraic Topology, I.** Homological algebra techniques, simplicial and singular homology, fundamental group and covering spaces, applications. Prerequisite: Mathematics 318 and 332; registration in Mathematics 401 or consent of instructor. 1 unit.
432. **Algebraic Topology, II.** Continuation of Mathematics 431. Axiomatic homology theory, fibrations and cofibrations, CW-complexes, cohomology products, other topics. Prerequisite: Mathematics 431; registration in Mathematics 402. 1 unit.
433. **Fiber Spaces and Characteristic Classes.** Continuation of Mathematics 432. Study of fiber bundles and their associated characteristic classes; applications to geometric problems. Prerequisite: Mathematics 432. 1 unit.
434. **Polyhedral Topology.** Topology in the piecewise linear category. Prerequisite: Mathematics 431 and 435. 1 unit.
435. **General Topology, I.** Study of topological spaces and maps, including Cartesian products, identifications, connectedness, compactness, uniform spaces, function spaces. Prerequisite: Mathematics 332 or consent of instructor. 1 unit.
436. **General Topology, II.** Continuation of Mathematics 435. Prerequisite: Mathematics 435. 1 unit.
438. **Topics in Topology.** Prerequisite: Consent of instructor. 1 unit.
439. **Seminar in Topology.** Prerequisite: Consent of instructor. 1 unit.
440. **Theory of Functions of a Complex Variable, I.** Topics include the Cauchy theory, harmonic functions, entire and meromorphic functions, and the Riemann mapping theorem. Prerequisite: Mathematics 346 and 347, or Mathematics 348. 1 unit.
441. **Real Analysis, I.** Lebesgue measure on the real line, integration and differentiation of real valued functions of a real variable; additional topics at discretion of instructor. Prerequisite: Mathematics 347 or equivalent. 1 unit.

442. **Real Analysis, II.** Abstract measure theory, integration on general measure spaces; introduction to functional analysis. Prerequisite: Mathematics 441. 1 unit.
443. **Ordinary Differential Equations.** Existence, uniqueness, and continuation of solutions; topics selected from: the theory of linear differential operators, Sturm-Liouville theory, stability theory, qualitative theory of differential equations. Prerequisite: Mathematics 347; a first course in ordinary differential equations. 1 unit.
444. **Partial Differential Equations.** Prerequisite: Consent of instructor. 1 unit.
445. **Theory of Functions of a Complex Variable, II.** Continuation of Mathematics 440. Topics include subharmonic functions, Nevanlinna theory, analytic continuation and Riemann surfaces, and univalent functions. Prerequisite: Mathematics 440. 1 unit.
446. **Hilbert Space.** Geometrical properties of Hilbert spaces; linear operators; the spectral theory for self adjoint and related operators. Prerequisite: Mathematics 442. 1 unit.
447. **Banach Spaces.** Geometrical properties of Banach spaces; bounded linear operators; applications to analysis; linear topological spaces. Prerequisite: Mathematics 442. 1 unit.
448. **Harmonic Analysis.** Locally compact groups, Haar measure, Fourier analysis, and Tauberian theorems. Prerequisite: Mathematics 442. 1 unit.
449. **Normed Rings.** Properties of normed rings; representation as rings of continuous functions or rings of bounded operators; applications to spectral theory, harmonic analysis, etc. Prerequisite: Mathematics 318; Mathematics 446 or 447. 1 unit.
450. **Ordered Spaces.** A study of ordered topological vector spaces and vector lattices and positive operators. Prerequisite: Mathematics 442 and 447. 1 unit.
451. **Theory of Probability.** Prerequisite: Mathematics 442. 1 unit.
452. **Theory of Probability.** Prerequisite: Mathematics 451. 1 unit.
453. **Analytic Theory of Numbers, I.** Problems in number theory treated by methods of analysis. Topics chosen from prime number theory, Riemann zeta function, sieve methods, diophantine approximation, metric theory, partitions, lattice points, Waring's problem, asymptotic properties of arithmetical functions. Prerequisite: Mathematics 317 or 348. 1 unit.
454. **Analytic Theory of Numbers, II.** Continuation of Mathematics 453. Prerequisite: Mathematics 453. 1 unit.
455. **Mathematical Methods of Physics.** Prerequisite: Mathematics 348. 1 unit.
456. **Mathematical Methods of Physics.** Prerequisite: Mathematics 455. 1 unit.
457. **Advanced Numerical Analysis.** Same as Computer Science 457. Ordinary differential equations: existence theory of Picard, one-step and multi-step methods, discretization error, convergence, stability, boundary value problems: integral equations. Prerequisite: Mathematics 387 or consent of instructor. 1 unit.
458. **Numerical Solution of Partial Differential Equations.** Same as Computer Science 458. The numerical solution of initial and boundary value problems for partial differential equations; topics include the approximation of differential operators by difference operators, the solution of large systems of linear equations by iterative methods, and discussion of convergence and numerical stability. Prerequisite: Computer Science or Mathematics 457, or consent of instructor. 1 unit.
460. **Relativity and Cosmology.** Same as Astronomy and Physics 424. Elements of tensor calculus and Riemannian geometry; special relativity; Lorentz transformations, equivalence of mass and energy; general relativity and the gravitational field of the sun; galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit. MCVITTIE.
461. **Applied Stochastic Processes.** Introduction to topics such as spectral analysis, filtering theory, and prediction theory of stationary processes; Markov chains and Markov processes. Prerequisite: Mathematics 346 and 347. 1 unit.
463. **Information Theory.** Same as Computer Science and Electrical Engineering 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361. 1 unit.

465. **Topics in Automata Theory.** Same as Computer Science and Electrical Engineering 465. Prerequisite: Mathematics 392 or consent of instructor. 1 unit.
468. **Topics in Analysis.** Prerequisite: Consent of instructor. 1 unit.
469. **Seminar in Analysis.** Prerequisite: Consent of instructor. 1 unit.
470. **Statistical Decision Functions.** Statistics from the point of view of decision-making; introduction to the theory of games; minimax and other decision functions; techniques for determining optimal decision functions; applications to nonsequential and sequential decision-making in practice. Prerequisite: Consent of instructor. 1 unit.
473. **The Theory of Testing Hypotheses.** Methods of constructing statistical tests which have optimum properties in small samples; the principles of invariance, unbiasedness and similarity; most stringent tests and minimax tests. Prerequisite: Consent of instructor. 1 unit.
474. **The Theory of Estimation.** Methods of constructing uniformly minimum variance unbiased estimates; minimax estimation; estimation by confidence sets. Prerequisite: Consent of instructor. 1 unit.
478. **Topics in Statistics.** Prerequisite: Consent of instructor. 1 unit.
487. **Theory of Approximation.** Same as Computer Science 487. General approximation theory in normed linear spaces with primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Chebyshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants as approximants; use of approximations in computing. Prerequisite: Mathematics 318 and 348, or consent of instructor. 1 unit.
488. **Topics in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
489. **Seminar in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
490. **Reading Course.** Prerequisite: Consent of instructor. 1 to 2 units.
499. **Thesis Research.** Prerequisite: Consent of instructor. 0 to 4 units.

MECHANICAL AND INDUSTRIAL ENGINEERING

Head of Department: Professor H. H. KORST

Department Office: 144 Mechanical Engineering Building

Mechanical Engineering

180. **Engineering Materials and Processes.** Study of the materials, equipment, and processes used in the manufacture of goods. Designed for students in nonengineering curricula, this course correlates materials and the methods used in their processing. Prerequisite: Sophomore standing. 3 hours.
182. **Manufacturing Process.** Technical aspects of manufacturing processes; basic mechanics and geometry of chip formation; flow and solidification of molten alloys; cold forming processes; joining, welding, and heat treatment. Prerequisite: Credit or registration in Physics 107 and Mathematics 140, 141, or 145. 3 hours.
185. **Materials Processing and Production Technology.** Technical aspects of manufacturing processes; principles of metal casting, welding, and other processes involving application of heat; mechanics of chip formation; cold forming processes; conventional and nonconventional metal removal processes. Laboratory experiments and reports. Prerequisite: Chemistry 102; Physics 106; credit or registration in Mathematics 140, 141, or 145. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
202. **Thermodynamics and Heat Transfer.** Heat and work transfers and their effects on

- properties of simple working media undergoing nonflow and steady-flow processes; heat transfer by conduction, convection, and radiation. Prerequisite: Mathematics 345; Physics 107; Theoretical and Applied Mechanics 154 or 211. 3 hours.
205. **Thermodynamics.** Energy and its transformation; properties of thermodynamic systems; non-flow and steady-flow processes of fluids; reversibility and limitations; behavior of gases, liquids, and vapors; entropy and the second law; thermodynamic temperature scales and heat engines. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
206. **Thermodynamics.** Analysis of steady flow of fluids in pipes, nozzles, orifices, power plant equipment; air compressor, blower, fan, and pilot tube energy relations; detailed analysis of turbines; power and refrigeration cycles; thermodynamic properties of moist air and applications in air-conditioning processes; combustion. Prerequisite: Mechanical Engineering 205. 3 hours.
207. **Thermodynamics.** Energy and its transformations; properties of thermodynamic media, including kinetic theory analysis; thermodynamic processes of open and closed systems; reversibility and limitations; entropy and the second law; thermodynamics temperature scales; second law analysis of chemically reactive systems. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
209. **Thermodynamics and Heat Transfer.** Thermodynamic analysis of energy transfer and transformation; properties of simple working substances; analysis of open and closed systems, direct and reversed cycles, and processes involving transfers of mass and energy; basic laws of heat transfer. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
210. **Introduction to Engineering Experimentation.** Design and planning of engineering experiments on the basis of scientific analysis; execution of basic engineering experiments using fundamental measurement instruments and techniques; analysis, correlation, and evaluation of experimental data using mathematical and statistical concepts; introduction and utilization of analog and digital computer methods. Prerequisite: Registration in Mathematics 345 and Mechanical Engineering 220. 3 hours.
211. **Introductory Gas Dynamics.** Introduction to dynamics, with special emphasis on the theory and engineering applications of compressible high velocity flows. Prerequisite: Mathematics 345; credit or registration in Mechanical Engineering 210; Physics 107. 3 hours.
213. **Heat Transfer.** Principles and application of heat transfer by conduction, convection, and thermal radiation. Students are not given credit for both Mechanical Engineering 213 and 254. Prerequisite: Mechanical Engineering 211. 3 hours.
220. **Mechanics of Machinery.** Linkages, cams, and gears, velocities, accelerations, inertia forces, vibrations and critical speeds, balancing of engines, gyroscopes. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or registration in Theoretical and Applied Mechanics 211; credit or registration in Computer Science 101. 4 hours.
224. **Design of Machine Elements.** Application of the principles of mechanics and physical properties of materials to the proportioning of machine elements, including consideration of function, production, and economic factors. Prerequisite: Mechanical Engineering 220; Theoretical and Applied Mechanics 221. 3 hours.
234. **Heat Treatment of Metals.** Effects of heat treatment upon physical properties and structure of metals; heat treating operations; study of structures and physical properties; hardenability, grain size; special steels for extreme service requirements; selection and heat treatment of steels based on performance requirements. Prerequisite: Theoretical and Applied Mechanics 221; credit or registration in Mechanical Engineering 224. 3 hours.
250. **Thermoscience Laboratory.** Basic experiments in thermodynamics, gas dynamics, and heat transfer and their applications. Experiments are selected to introduce pertinent instrumentation, experimental techniques, and to further the understanding of fundamentals via physical observations. Prerequisite: Mechanical Engineering 205 and 213. 3 hours.

254. **Heat Transfer and Gas Dynamics.** Principles and applications of heat transfer; basic concepts of compressible fluid flow. Students are not given credit for both Mechanical Engineering 213 and 254. Prerequisite: Mechanical Engineering 205; credit or registration in Theoretical and Applied Mechanics 235. 3 hours.
257. **Gas Turbines.** Theory, analysis, and performance of gas turbines; thermodynamic cycle analysis; performance parameters; structural components and gas dynamics of turbine blades, centrifugal and axial compressors. Basic laboratory work involving fundamental variables and their effect on performance. Prerequisite: Mechanical Engineering 206 or equivalent. 3 hours.
260. **Air Flow and Conditioning.** Synthesis of principles of fluid mechanics, heat transfer, and thermodynamics in the flow and conditioning of air; combined heat- and mass-transfer relations for the air-water vapor system; applications to the engineering design of heating, ventilating, air conditioning, and other process-industry systems. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours.
265. **Principles of Control Systems.** Introduction to servomechanisms and control systems; modeling of dynamic elements, linearization, and block diagram algebra; steady state, transient response, and frequency response of control systems; stability criteria, design, compensation, and performance characteristics. Prerequisite: Mechanical Engineering 210 or senior standing, or consent of instructor. 3 hours.
271. **Design of Machine Elements.** Continuation of Mechanical Engineering 224. Prerequisite: Mechanical Engineering 224. 3 hours.
275. **Creativity in Engineering Design.** A study of engineering systems to show the creative use of scientific principles and design procedures. Survey of natural laws and examples of their creative application. Introduction to methods for promoting creativity in engineering. Prerequisite: Mechanical Engineering 271. 3 hours.
284. **Welding Engineering.** Study of the fundamentals of welding processes and design of weldments; types, characteristics, and performance of various welding machines and processes; resistance welding and machine welding; inspection and testing of welds; design of weldments based upon suitable size, type, and location of welds; application to the production of machines and structures; supplemented by laboratory experiments. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours.
290. **Senior Project Laboratory.** The planning, designing, execution, and evaluation of a technical project in order to provide the student with an opportunity to assume individual responsibility in this area. Responsibility for the selection, development, and completion of the project is placed on the student, subject to consent of the instructor. Prerequisite: Senior standing in mechanical engineering. 2 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of mechanical engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in mechanical engineering. Must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in mechanical engineering research. Prerequisite: Senior standing in mechanical engineering; consent of head of department. 3 hours.
296. **Honors Project.** Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Mechanical Engineering 293 or 296. 3 hours.
301. **Thermodynamics.** Basic considerations of the three laws of thermodynamics; elementary statistical principles for the prediction of properties of pure substances and mixtures;

- transport properties; electric and magnetic systems. Prerequisite: Mechanical Engineering 206 or equivalent; consent of instructor. 3 hours, or 3/4 or 1 unit.
302. **Nuclear Power Engineering.** Same as Nuclear Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering, including such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
303. **Dynamics of Aerosols and Hydrosols.** Theory and application of the basic relations of fluid dynamics, thermodynamics, and heat transfer to the motion of aerosols and hydrosols, with application to problems in air and water pollution. Prerequisite: Senior or graduate standing. 3 hours or 1 unit.
304. **Direct Energy Conversion.** Direct conversion of chemical, nuclear, and solar energies into electricity by electrochemical, thermionic, thermoelectric, photoelectric, photochemical, ferroelectric, magnetohydrodynamic, and plasma systems. Prerequisite: Mechanical Engineering 301 or consent of instructor; Mathematics 345. 3 hours, or 3/4 or 1 unit.
305. **Thermodynamics of High-Velocity Flow.** The thermodynamics of gases during high-velocity flow within enclosed channels using Mach number as the fundamental variable; analyses of the basic flow equations, effects of friction, and plane shock theory; application to thermodynamic cycles involving nozzles, diffusers, compressors, combustion, and turbines. Prerequisite: Mechanical Engineering 205 and 211, or equivalent. 3 hours, or 3/4 or 1 unit.
306. **Industrial Heat Transfer.** Theory and application of numerical, analogical, and experimental methods to selected heat transfer problems; application of principles of convection, condensation, and boiling heat transfer to design of heat exchange equipment. Prerequisite: Undergraduate courses in fluid mechanics and heat transfer. 4 hours or 1 unit.
309. **Experimental Gas Dynamics.** Experimental investigation of problems in the field of compressible fluid flow within enclosed channels. Prerequisite: Mechanical Engineering 211 and 305, or equivalent. 4 hours or 1 unit.
311. **Instrumentation and Measurements.** Same as Agricultural Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or 3/4 or 1 unit.
312. **Modern Control Theory.** The concept of state; state-space representation of systems; transfer function decomposition, state-variable diagrams; state response of continuous and discrete-data systems; determination of the transition matrix; diagonalization; state response of time-varying systems; controllability and observability; stability and Lyapunov's method; introduction to optimization and design. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.
314. **Lubrication.** The theoretical basis of lubrication, hydrodynamic bearing theory, properties of lubricants; lubrication methods and appliances; study of the lubrication requirements of machines of many kinds. Prerequisite: Undergraduate courses in machine design and fluid mechanics. 3 hours, or 3/4 or 1 unit.
321. **Refrigeration and Cryogenics.** The theory of operation and the design of equipment for the production of low temperatures from below ambient down to near absolute zero. Applications to industrial, consumer, aerospace, medical, and various research uses. Prerequisite: Mechanical Engineering 206, 211, and 213, or equivalent. 3 hours, or 3/4 or 1 unit.
323. **Design of Thermal Systems.** Selection of components in fluid- and energy-processing systems to meet system performance requirements, computer-aided design, system simulation, optimization techniques, investment economics and statistical combinations of operating conditions. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours, or 3/4 or 1 unit.

331. **Internal Combustion Engines.** A study of the fundamental principles underlying the theory and analysis of reciprocating internal combustion engines, fuels, carburetion, combustion, exhaust emissions, detonation, fuel injection, and factors affecting performance. Basic laboratory work involving measurements of effects of variables on performance. Prerequisite: Mechanical Engineering 206 or consent of instructor. 3 hours, or 3/4 or 1 unit.
332. **Theory of Internal Combustion Engines.** Analysis of reciprocating engine cycle, including thermodynamics and combustion, taking into consideration effects of fuel-air mixture, variable specific heats, chemical equilibrium and dissociation, and heat losses; flow through manifolds and valves; factors affecting breathing and scavenging; supercharging; bearings, lubrication, and friction; effects of variables on performance. Prerequisite: Undergraduate course in internal combustion engines or consent of instructor. 3 hours, or 3/4 or 1 unit.
335. **Power Systems Engineering and Economy.** Application of thermodynamics principles and fluid flow and heat transfer processes to power systems; determination of system characteristics and methods to satisfy these requirements with awareness of economic factors and ecological considerations. Prerequisite: Mechanical 206, 211, and 213, or their equivalents. 3 hours, or 3/4 or 1 unit.
336. **Automotive Vehicle Dynamics.** Introduction to the dynamics and control of automotive multi-degree of freedom systems. The governing equations are developed and solved for both steady state and transient conditions by computer simulation techniques. The performance, handling, and safety aspects of vehicles and their interaction with external and internal interfaces are investigated. The influence of tires, suspension, steering, and aerodynamic forces are examined. Laboratory experiments and demonstrations are included. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.
341. **Engineering Analysis and Design.** Correlation of previously acquired design experience with the creative problem of synthesis and analysis that depend upon design judgment. Prerequisite: Mechanical Engineering 271, senior standing, or consent of instructor. 3 hours, or 3/4 or 1 unit.
342. **Kinematic Analysis and Synthesis.** Geometry of constrained motion; application of mathematical and other techniques to the kinematic analysis and synthesis of mechanisms. Prerequisite: Undergraduate course in kinematics and senior standing, or consent of instructor. 3 hours, or 3/4 or 1 unit.
343. **Dynamics of Machinery.** A course complementary to the undergraduate course with emphasis on the analytical approach to the study of dynamic forces in machines, balancing, critical speeds, shaft vibration, governors, and gyroscopes. Prerequisite: Mechanical Engineering 220 and senior standing, or consent of instructor. 3 hours, or 3/4 or 1 unit.
348. **Air Pollution Seminar.** Same as Civil Engineering, Agricultural Engineering, General Engineering, Geography, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
388. **Industrial Control Systems.** The study of industrial control techniques by case studies of actual industrial systems. The course provides competence in the design, selection, and maintenance of industrial control systems. Applications to electro-mechanical, pneumatic, thermal, and hydraulic systems. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 3 hours, or 3/4 or 1 unit.
393. **Special Problems.** Study of advanced problems related to mechanical engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or 1/2 to 1 unit.
401. **Thermodynamics and Transport Properties.** Thermodynamics and microscopic considerations for the prediction of properties. Caratheodory principle, relations among properties; microscopic considerations and statistical methods; thermodynamic and

- transport properties; fluctuation and non-equilibrium thermodynamics. Prerequisite: Mechanical Engineering 301 or consent of instructor. 1 unit.
402. **Non-Equilibrium Processes.** Dynamics and thermodynamics of multiphase and multi-component systems with special relevance to air pollution control and energy conversion; relaxation phenomena, general motion of systems of disparate elemental masses, diffusion in gravitational and electric fields, boundary layer motion with mass transport, dispersion and collection of particular matter, transport with surface reactions. Prerequisite: Mechanical Engineering 301 and 303, or consent of instructor. 1 unit.
403. **Fundamentals of Combustion.** Same as Aeronautical and Astronautical Engineering 438. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames, their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; supersonic burning. Prerequisite: Mechanical Engineering 305 or Aeronautical and Astronautical Engineering 213. 1 unit.
404. **Gas Dynamics, I.** Introduction to theoretical gas dynamics; fundamental laws and basic equations for subsonic, transonic, and supersonic steady and unsteady flow processes. Prerequisite: Mechanical Engineering 305 or equivalent, or consent of instructor. 1 unit.
405. **Convective Heat Transfer.** Fundamentals of convective heat transfer; calculation of heat transfer within conductor and over submerged objects for laminar and turbulent flow; natural convection; film condensation and boiling; liquid metals. Prerequisite: Mechanical Engineering 306 or consent of instructor. 1 unit.
406. **Heat Conduction in Solids.** Fundamentals of heat conduction in isotropic and anisotropic solids; methods of solution to steady and transient heat conduction problems in one, two, and three dimensions; internal heat sources; periodic flow of heat; problems involving phase change; approximate analytical techniques. Prerequisite: Mechanical Engineering 306, Mathematics 346, or consent of instructor. 1 unit.
407. **Gas Dynamics, II.** Continuation of study of theoretical gas dynamics, study of incompressible, subsonic, transonic, supersonic, and hypersonic flows emphasizing viscous-inviscid interaction between streams; also topics of interest leading to graduate research. Prerequisite: Mechanical Engineering 404 or equivalent. 1 unit.
408. **Laboratory Investigation in Thermodynamics.** Special investigations involving thermodynamics analysis, thermodynamic properties, and performance of physical and chemical systems. Prerequisite: One-year course in thermodynamics; one half-year course in power laboratory. 1/2 to 1 1/2 units.
409. **Laboratory Investigations in Fluid Flow, Heat Transfer, and Combustion.** Special investigation in flow, metering, heat transfer, heat exchanger performance and design. Prerequisite: Courses in thermodynamics and fluid mechanics. 1/2 to 1 1/2 units.
410. **Thermal Radiation.** Fundamentals of radiant energy transport in absorbing and non-absorbing media; pyrometry; applications to selected problems involving combined energy transport mechanisms. Prerequisite: Mechanical engineering 306 or consent of instructor. 1 unit.
421. **Environmental Control.** Same as Architecture 421. Design of environmental systems for buildings. Integration of mechanical, structural, and architectural demands, in lectures and through a semester design project. Prerequisite: Undergraduate courses in heat transfer and fluid mechanics. 1 unit.
423. **Thermal Systems.** Steady-state simulation and optimization of thermal systems, dynamic performance, and probabilities in system design. Prerequisite: Mechanical Engineering 323. 1 unit.
428. **Investigations in Thermal Systems.** Investigations in the modeling, simulation, and optimization of thermal systems such as power generating, heating and cooling, and thermal processing systems. 1/2 to 1 1/2 units.
429. **Investigations in Environmental Control.** Investigations in heating, ventilating, air conditioning, and human comforts. 1/2 to 1 1/2 units.

- 432. Theory of Rotary Compressors.** Thermodynamical and mechanical fundamentals, compression with and without cooling, classification of compressors, similarity considerations and characteristics, principles of and computations for radial compressors, improvement in performance of integrating parts; axial flow compressors; lattice and airfoil theory; change in operating conditions of turbo-compressors; regulation; rotary positive blowers. Prerequisite: Mechanical Engineering 205, 206, and 211; or Theoretical and Applied Mechanics 232; or Aeronautical and Astronautical Engineering 211. 1 unit.
- 438. Laboratory Investigations in Power Machinery.** Special investigations in power machinery, such as turbines, engines, fans, and compressors. Prerequisite: One-year course in power laboratory. 1/2 to 1 1/2 units.
- 441. Machine Design.** A technical application course designed to focus the previously acquired design experience on the creative problem of developing machines to perform specified functions; proper considerations of manufacturing processes involved; checking of all parts for stress, wear, vibration, fatigue, etc. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.
- 442. Linkage Synthesis.** Geometry of constrained motion in two and three dimensions; application of mathematical and other techniques to the synthesis of mechanisms. Prerequisite: Mechanical Engineering 342 or consent of instructor. 1 unit.
- 443. Dynamics of Machinery.** Complementary to the undergraduate course and devoted to a more detailed study of velocities, accelerations, and forces in machine parts having reciprocating, rotating, and combined motions; balancing, flywheels; special topics. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.
- 445. Design of Internal Combustion Engines.** Detailed study of the design of the internal combustion engine; gas-pressure and inertia-force diagrams; determination of bearing loads; torsional vibration analysis; stress determinations and design of important parts, including piston, connecting rod, crankshaft, flywheel, valve mechanism, and cam layout. Prerequisite: Undergraduate courses in dynamics of machines and in internal combustion engines; one year of machine design. 1 unit.
- 448. Laboratory Investigations in Machine Design.** Special investigations in machine design. 1/2 to 1 1/2 units.
- 451. Theory of Metal Cutting.** A study of the theoretical factors involved in metal cutting and forming; basic mechanics of chip formation, friction, surface damage and finish; temperatures and temperature distribution during cutting; wear and tool-work compatibility. Analysis of experimental data; critical review of pertinent literature and special topic assignments. Prerequisite: Undergraduate course in principles of metal cutting and heat treatment of metals or physical metallurgy. 1 unit.
- 452. Deformation and Mechanical Processing of Metals.** Theoretical and experimental aspects of deformation and mechanical processing of metals. Plastic deformation; fracture and fatigue; impact stresses and stress waves in metals; thermal and residual stresses; plastic forming of metals and its influence on the properties. Prerequisite: Mechanical Engineering 451; Metallurgical Engineering 408. 1 unit.
- 458. Laboratory Investigations in Production.** Special investigations in field of production, particularly in materials processing, metal cutting, and production engineering. 1/2 to 1 1/2 units.
- 493. Seminar.** Required of all graduate students each semester with the exception of doctoral candidates who have passed their preliminary examination. Presentation and discussion of significant developments in mechanical engineering. 0 credit.
- 497. Special Problems in Mechanical Engineering.** Lectures, seminars, and individual investigations or studies in selected areas of mechanical engineering. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated.
- 499. Thesis Research.** 0 to 4 units.

Industrial Engineering

199. **Undergraduate Open Seminar.** 0 to 9 hours.
230. **Labor Relations.** The individual and his coordination, orientation, and maintenance in the group and in the business organization; the service, functions, regulations, union aspects, wage-price structure, and public considerations affecting labor-management relationships in various organizations. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.
232. **Methods-Time Analysis.** Principles of motion economy affecting the design of a product or service; the effective use of human effort as related to the tools and equipment used in manufacturing and commercial endeavors; reasons for time study and the principles of determining time standards; study of standard data and other specific types of micromotion standards. Applications of all phases of the studies to specific cases. Prerequisite: Mechanical Engineering 185 or equivalent; junior standing. 3 hours.
233. **Industrial Quality Control.** Shewhart control charts, acceptance sampling, rationalization of tolerances and specifications, organization and administration of quality control programs. Prerequisite: Junior standing. 3 hours.
282. **Process Planning and Economy in Manufacturing.** The principles of engineering economy and their applications to manufacturing problems. Studies of typical manufacturing processes and their economic factors, and exercises in planning processes for maximum efficiency. Prerequisite: Mechanical Engineering 185 or equivalent; senior standing in engineering. Credit is not given for both Industrial Engineering 282 and 382. 3 hours.
286. **Operations Analysis.** The development and application of schematic and mathematical models for analysis and decision-making relative to the task of coordinating manufacturing activities at optimum levels of economy and efficiency. Linear programming is stressed. Prerequisite: Industrial Engineering 232 and Mathematics 263, or consent of instructor. 3 hours.
287. **Job Evaluation and Wage Incentives.** A study of job evaluation techniques and wage incentive systems; and problems of installing and maintaining job and position evaluation systems in industrial organizations. Prerequisite: Industrial Engineering 232 or equivalent; senior standing. 3 hours.
288. **Industrial Systems Analysis and Design.** Application of systems approach to the analysis of interacting industrial procedures. Development of decision rules based on analytical treatment of system variables rather than by judgmental methods. Application of computers to the total synthesis and evaluation of operational procedures. Prerequisite: Credit or registration in Industrial Engineering 282 and 286. 3 hours.
290. **Senior Project Laboratory.** The planning, designing, execution, and evaluation of a technical project with the student assuming individual responsibility for the project. The responsibility for selection, development, and completion of the project is placed on the student with the advice and consent of the instructor. Prerequisite: Senior standing in industrial engineering. 2 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of industrial engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in industrial engineering. Must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in industrial engineering research. Prerequisite: Senior standing in industrial engineering; consent of head of department. 3 hours.
296. **Honors Project.** Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester to bring the James Scholars in engineering into direct contact with the various

aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Industrial Engineering 293 or 296. 3 hours.
305. **Principles of Ergonomics.** Same as Physiology and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work. Such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems are considered. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Physiology and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments. Students become familiar with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair; high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Industrial Engineering 305. 4 hours or 1 unit.
332. **Standard Time Systems.** The study of development, uses, and limitations of standard time data and predetermined time systems. Prerequisite: Industrial Engineering 232. 3 hours, or 3/4 or 1 unit.
333. **Engineering Applications of Statistics.** Applications of statistics to engineering problems; the calculated risk in making decision on observed data; treatment of means, percentage, and variability; control charts, acceptance sampling, linear regression, correlation, elementary experimental design. Use of desk calculators. Prerequisite: Mathematics 263 or 363. 3 hours, or 3/4 or 1 unit.
334. **Introduction to Reliability Engineering.** Same as General Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 333 or Mathematics 361 or equivalent with consent of instructor. 3 hours, or 3/4 or 1 unit.
336. **Design and Analysis of Industrial Experimentation.** t-tests, randomized blocks, factorial and fractional factorial designs; concepts of randomization, blocking, screening, confounding; second order designs, response surface methodology, evolutionary operation; introduction to mechanistic model building and non-linear estimation. All topics treated through engineering applications and case studies. Prerequisite: Industrial Engineering 333 or equivalent, or consent of instructor. 3 hours, or 3/4 or 1 unit.
350. **Manufacturing Process and Tool Design.** A study of and exercises in the design of manufacturing processes and tools for maximum efficiency. The utilization of computer techniques in the design of manufacturing processes and tools. Prerequisite: Industrial Engineering 282 or undergraduate course in engineering economy. 3 hours, or 3/4 or 1 unit.
355. **Numerical Control of Manufacturing Processes.** A study of numerical control systems, manufacturing processes, principles and practices basic to numerical control, and programming methodology for numerical control. Prerequisite: Mechanical Engineering 185 or consent of instructor; background in computer technology. 3 hours, or 3/4 or 1 unit.
357. **Safety Engineering.** The study of engineering principles applied to industrial accident prevention; safe plant layout, safety in maintenance, boilers and pressure vessels, design and application of machine guards, material handling and storage, hand and power tools, welding hazards, electrical hazards, flammable liquids and fire protection, industrial health engineering, and toxic materials. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours, or 3/4 or 1 unit.

358. **Problems in Safety Engineering.** Extended and intensified study of specific safety problems; study of industrial safety procedures and methods of application. Designed to provide sound knowledge of accident prevention principles and applications for the student interested in entering the field of safety engineering in industry. Prerequisite: Industrial Engineering 357 or consent of instructor. 3 hours, or 3/4 or 1 unit.
382. **Design of Manufacturing Processing Systems.** Optimization in selection and arrangement of components of manufacturing process systems to produce parts to design specifications at lowest cost. System simulation and optimization with particular reference to computer utilization and recognition of risk and uncertainty. Credit is not given for both Industrial Engineering 382 and 282. Prerequisite: Computer Science 101; Mechanical Engineering 185 and 234. 3 hours, or 3/4 or 1 unit.
386. **Industrial Engineering Analysis.** Analysis and development of analytical techniques for the solution of problems in industrial engineering; application of statistical methods to uncertainty problems; analysis of linear programming techniques appropriate to the solution of allocation problems dealing with materials, money, men, and machines; queuing theories applied to maintenance and inventories. Prerequisite: Industrial Engineering 286 and Mathematics 263, or consent of instructor. 3 hours, or 3/4 or 1 unit.
393. **Special Problems.** Study of advanced problems related to industrial engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or 1/2 to 1 unit.
401. **Scientific Management, I.** Same as Business Administration 401. A study of modern management principles on the basis of quantitative methods, concentrating on such operation research techniques as nonlinear and dynamic programming and queueing theory. Prerequisite: Industrial Engineering 386 and Mathematics 361, or consent of instructor. 1 unit.
402. **Scientific Management, II.** Same as Business Administration 402. A systems approach to industrial problems involving inventory control, scheduling and line balancing, maintenance and investment theory; application of formally accumulated knowledge of operation research techniques. Problems from industry are assigned to small teams of students. Prerequisite: Business Administration or Industrial Engineering 401; background in computer technology or consent of instructor. 1 unit.
416. **Design of Construction and Industrial Operations, I.** Same as Civil Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues and inventory models required for systems design; design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering; credit or registration in Mathematics 363; or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Civil Engineering 417. Continuation of Industrial Engineering 416. Prerequisite: Industrial Engineering or Civil Engineering 416; credit or registration in Mathematics 315; or consent of instructor. 1 unit.
453. **Work Measurement.** A study of special problems of line balance, interference, and automation work loads as required to establish work standards (or production standards). Prerequisite: Industrial Engineering 332. 1 unit.
454. **Production Engineering.** Advanced consideration of production engineering principles as related to cost analysis and reduction, control of flow of work in manufacture, evaluation of performance against standard, and compensation. Special investigations. Prerequisite: Industrial Engineering 453. 1 unit.
458. **Laboratory Investigations in Industrial Engineering.** Special investigations of such problems as optimization of operations, programming systems, work standards, plant layout, and flow of materials. 1/2 to 1 1/2 units.
473. **Ergonomics Seminar.** Same as Physiology and Physical Education 473. Topics in ergonomics are explored in depth, such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Industrial Engineering 305 or consent of instructor. 1/2 unit.

MEDICAL SCIENCES

Office: 1205 West California Avenue, Urbana

- 300. Medical Sciences.** First-year program in preparation for the M.D. degree involving independent study of anatomy, behavioral science, biochemistry, genetics, immunology, microbiology, neural science, pathology, pharmacology, physiology, and reproductive biology. Elements of clinical experience are included. Learning experiences are monitored and presented by faculty in the clinical and basic medical sciences. Prerequisite: Enrollment is limited to students accepted by the College of Medicine. 19 hours.

METALLURGY AND MINING ENGINEERING

(Including Petroleum Engineering)

Head of Department: Professor C. A. WERT

Department Office: 201 Metallurgy and Mining Building

Metallurgical Engineering

- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 201. Physical Metallurgy, I.** Constitutional diagrams; equilibrium and nonequilibrium conditions; properties of metals and alloys related to structure; elementary physics of metals. Prerequisite: Physics 107. 3 hours.
- 203. Physical Metallurgy Laboratory, I.** Construction of simple binary constitution diagrams; study of microstructures of binary alloys; demonstration of the principles of solidification, cold working, and heat treatment of metals. Prerequisite: Registration in Metallurgical Engineering 201. 1 hour.
- 207. Extractive Metallurgy.** Basic processes for the recovery of metals from their ores; mineral beneficiation; smelting, refining, and related processes; hydrometallurgical methods. Prerequisite: Junior standing in metallurgical engineering or equivalent. 3 hours.
- 208. Physical Metallurgy, II.** Composition, internal structure, treatment, and properties of iron, plain carbon steel, and cast iron. Credit is not granted for both Metallurgical Engineering 208 and 387. Prerequisite: Metallurgical Engineering 201 and 203. 3 hours.
- 210. Physical Metallurgy Laboratory, II.** Metallographic preparation of ferrous metal specimens; use of metallurgical microscope; photomicrography; analysis and interpretation of structures developed by heat treatment and by mechanical working. Prerequisite: Registration in Metallurgical Engineering 208. 3 hours.
- 251. Physical Metallurgy, III.** Internal structure, constitution, treatment, and properties of non-ferrous metals and alloys. Credit is not granted for both Metallurgical Engineering 251 and 387. Prerequisite: Metallurgical Engineering 201 and 203. 3 hours.
- 253. Physical Metallurgy Laboratory, III.** Preparation of metallographic specimens and interpretation of microstructures of commercial nonferrous alloys; copper, aluminum, magnesium, and titanium base alloys; bearing metals; die castings; and powder metallurgy alloys. Prerequisite: Registration in Metallurgical Engineering 251. 3 hours.
- 260. Advanced Physical Metallurgy Laboratory.** Laboratory problems in heat treatment; hardness measurement; transformation characteristics, hardenability and temperability of alloy steels. Prerequisite: Metallurgical Engineering 208 and 210; credit or registration in Metallurgical Engineering 251. 3 hours.
- 296. Metallurgical Seminar.** Review of current metallurgical literature; classroom reports and discussions; preparation of technical abstracts and reports. Prerequisite: Senior standing in metallurgical engineering. 2 hours.

299. **Thesis.** Investigation of special problems and preparation of a thesis. May be substituted for certain technical subjects in the senior year. Prerequisite: Senior standing; approval of head of department. 1 to 3 hours.
301. **Metallurgy of Welding.** Heat flow and thermal cycles in welding and cutting of metals; physical metallurgy and mechanical properties of weld metal and thermally altered base metal; joining methods in relation to composition, microstructure, and mechanical properties; specifications, economics, and service requirements. Prerequisite: Metallurgical Engineering 208 or equivalent. 3 hours, or 3/4 or 1 unit.
302. **Powder Metallurgy.** Production and testing of powdered metals; fabrication and application of metal shapes produced from powdered metals. Prerequisite: Approval of department; registration in Metallurgical Engineering 304; senior standing. 2 hours, or 1/2 or 3/4 unit.
304. **Powder Metallurgy Laboratory.** Experiments involving the testing, briquetting, sintering, repressing of metal powders, and the testing of sintered compacts. Prerequisite: Approval of department; registration in Metallurgical Engineering 302; senior standing. 1 hour or 1/4 unit.
306. **Design of Engineering Alloys.** A study of the fundamental principles which determine the constitution, structure, treatment, and application of alloy steels and other special-purpose high-performance alloys. Prerequisite: Metallurgical Engineering 208 and 311. 3 hours, or 3/4 or 1 unit.
307. **Corrosion of Metals.** Electrochemistry, thermodynamics, and kinetics of corrosion; behavior of ferrous and nonferrous metals; corrosion rates; corrosion control; cathodic and anodic protection; high-temperature corrosion; corrosion testing; electrolytic machining methods. Prerequisite: Mechanical Engineering 234 or equivalent. 3 hours, or 3/4 or 1 unit.
310. **X-ray Metallography.** X-ray generation and scattering with applications to problems in physical metallurgy, such as phase identification, the determination of solid solubility, the measurement of grain size and preferred orientation, and other topics. Prerequisite: Physics 108. 3 hours or 3/4 unit.
311. **Advanced Phase Diagrams.** Interpretation of multicomponent phase diagrams for metal systems. Prerequisite: Metallurgical Engineering 201 or equivalent. 2 hours or 1/2 unit.
314. **Metallurgical Thermodynamics.** Thermodynamic principles are applied to the study of phase and chemical equilibrium and to the calculation of free energy of phases. Prerequisite: Chemistry 245. 3 hours or 3/4 unit.
315. **Metallurgical Kinetics.** Diffusion and heat flow calculations and their applications to kinetics of metallurgical processes. Prerequisite: Metallurgical Engineering 208 and 314. 3 hours or 3/4 unit.
316. **Mechanical Metallurgy.** Fundamentals of plastic deformation of crystalline solids; elementary theory of statics and dynamics of dislocations; applications to deformation of single crystals and polycrystals; fracture; effect of metallurgical variables on mechanical properties. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or 3/4 unit.
318. **Physics of Metals.** The nature of the perfect and imperfect crystal, the electronic structure of solids, electrical conduction in metals and semiconductors, dielectric and magnetic properties of solids. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or 3/4 unit.
334. **Physical Metallurgy for Engineers.** Fundamentals of crystallography, imperfections, alloying, and deformation. Consideration of composition, temperature, and prior thermal and mechanical treatment in the use of metals, with emphasis on their mechanical properties. Prerequisite: Credit or registration in Theoretical and Applied Mechanics 221 or Aeronautical and Astronautical Engineering 224, or consent of instructor. 3 hours, or 3/4 or 1 unit.
384. **Properties of Solids.** Same as Electrical Engineering 384. Perfect and imperfect crystal lattices, electronic structure of solids including basic theory and applications to transport

properties of metals and semiconductors, semiconductor diodes, dielectric and magnetic properties of solids. Prerequisite: Physics 383. 3 hours or 3/4 unit.

386. **Electron Microscopy and Diffraction Theory.** Theory and application of transmission electron microscopy and diffraction with emphasis on thin crystals. Electron optics, interference phenomena, interpretation of images and diffraction patterns, specimen preparation, etc. Prerequisite: Metallurgical Engineering 310 or equivalent. 3 hours or 1 unit.
387. **Advanced Physical Metallurgy.** Continuation of Metallurgical Engineering 201. Relation of structure to properties of metals; phase transformations; surface reactions; effect of forming processes on properties. Credit is not granted for Metallurgical Engineering 387 in addition to Metallurgical Engineering 208 or 251. Prerequisite: Metallurgical Engineering 201 or 334, or consent of instructor. 3 hours or 3/4 unit.
388. **Advanced Physical Metallurgy Laboratory.** Use of physical and mechanical properties and metallography to study metals. To be taken with Metallurgical Engineering 387. Prerequisite: Registration in Metallurgical Engineering 387, or consent of instructor. 3 hours or 3/4 unit.
407. **Plastic Deformation and Annealing of Metals.** The mechanism and crystallography of plastic deformation of single crystals and of polycrystalline metals; annealing effects: recovery, subgrain growth and recrystallization; deformation textures and annealing textures. Prerequisite: Consent of instructor. 1 unit.
408. **Dislocations and Mechanical Properties of Metals.** General static and dynamic properties of single dislocations in crystals; dislocation interactions; properties of dislocation arrays; role of dislocations in metallurgical phenomena with particular emphasis on mechanical properties. Prerequisite: Consent of instructor. 1 unit.
409. **Crystal Physics.** The anisotropic properties of crystals treated by tensor and matrix methods with applications to paramagnetism, conduction and diffusion, thermoelectricity, deformation, elasticity, and martensitic transformations. The effects of crystal symmetry and the properties of aggregates are discussed. Prerequisite: Vector algebra, determinants, and thermodynamics; consent of instructor. 1 unit.
410. **Advanced X-Ray Metallography.** X-ray diffraction as applied to the study of metals and alloys; effects of cold work, annealing, substructures, preferred orientation and ordering, principles of electron and neutron diffraction. Prerequisite: Chemistry 427 or consent of instructor. 1 unit.
420. **Metallurgical Thermodynamics.** Fundamental thermodynamic considerations and applications of thermodynamics to metallurgical problems; particular emphasis on heterogeneous equilibrium and thermodynamic properties of solutions; topics approached from the viewpoints of both macroscopic thermodynamics and statistical mechanics. Prerequisite: Metallurgical Engineering 314 or equivalent. 1 unit.
421. **Kinetics of Phase Changes in Metals.** The viewpoint of statistical thermodynamics, rate theory, diffusion in solids, interface energy, nucleation theories, phenomenological analysis of nucleation and growth; application to crystal growth, diffusionless phase changes, oxidation, pearlite reaction, precipitation, sintering. Prerequisite: Metallurgical Engineering 420 or consent of instructor. 1 unit.
430. **Surface Physics.** Same as Physics 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction and structure; gas-solid collisions; Brownian motion, diffusion and evaporation; electron and ion emission, tunnelling; Van der Waals forces; theory of chemical interactions; kinetics and statistics of absorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
485. **Metallurgical Engineering Problems.** Individual study in areas of metallurgical engineering not covered by regular course offerings, carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. 1/4 to 2 units.
486. **Laboratory Investigations in Metallurgy.** Special investigations in metallurgy to provide an opportunity to employ some advanced experimental methods of research. Avail-

able only to non-thesis students enrolled in a Master of Science program. Prerequisite: Consent of instructor. 1/4 or 1/2 unit.

492. **Seminar on Surfaces.** Discussions and lectures on current research on surfaces and related areas. Prerequisite: Consent of instructor. 0 or 1/4 unit.
493. **Seminar on Anelasticity.** Lectures and discussions of the nature of anelasticity and its application to metallurgy. Prerequisite: Consent of instructor. 0 or 1/4 unit.
494. **Seminar on Phase Transformations in Metals.** Discussion of current research in this field including presentation by graduate students of their own work. Prerequisite: Consent of instructor. 0 or 1/4 unit.
495. **Seminar on Diffusion and Imperfections.** Lectures and discussions on diffusion and imperfections in crystalline solids. Prerequisite: Consent of instructor. 0 or 1/4 unit.
497. **Seminar on Alloy Phases.** Discussion and lectures on current research, including work by the graduate students, relating to the electronic structure and crystal structure of alloy phases. Prerequisite: Consent of instructor. 0 or 1/4 unit.
498. **Colloquium in Physical Metallurgy.** Review of current metallurgical research in other laboratories by visiting lecturers. Some of the research currently done in the department is also reviewed. Required of all graduate students in metallurgical engineering. No credit.
499. **Thesis Research.** Individual research in specialized problems under the supervision of members of the staff. 0 to 4 units.

Mining Engineering

302. **Political, Economic, and Environmental Aspects of Minerals and Their Utilization.** The availability and utilization of national and world mineral resources and the related environmental, economic, and political implications are examined through lectures, readings, student reports, panel discussions, guest speakers, field trips, and films. Prerequisite: Economics 108 or consent of instructor. 3 hours, or 3/4 or 1 unit.
351. **Geophysical Prospecting.** Same as Geology 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or 3/4 or 1 unit.
356. **Rock Mechanics.** Mechanical properties of rocks; design of mine openings in bedded, massive, and fractured rock; methods of support; drilling; blasting. Prerequisite: Mining Engineering 351. 3 hours, or 3/4 or 1 unit.
393. **Special Problems.** Individual studies of any phase of mining or petroleum engineering selected by the student and approved by his adviser and the staff member who supervises the study. Prerequisite: Consent of instructor. 0 to 4 hours, or 0 to 1 unit.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy and Ceramic Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces. Silicate surfaces and water adsorption are emphasized. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
497. **Special Problems.** Individual studies in areas of mining or petroleum engineering, not covered by regular course offerings, carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. 0 to 2 units.
499. **Thesis Research.** Individual research in some phase of the general field of mining or petroleum engineering under the supervision of a member of the staff. 0 to 4 units.

Petroleum Engineering

371. **Reservoir Mechanics, I.** The mechanics of the movement of fluids in the porous rock reservoirs of the subsurface, especially as related to questions dealing with the production

and storage of petroleum fluids, ground water, and natural gases. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 235. 3 hours or 1 unit.

- 373. Advanced Reservoir Engineering.** Physical principles of oil production including the hydrodynamics of the recovery process with attention given to the valuation and practical economic aspects. Prerequisite: Petroleum Engineering 372 or consent of instructor; Mathematics 345. 3 hours, or 3/4 or 1 unit.
- 420. Porous Media Hydromechanics.** Introduction to theoretical hydromechanics. Classification of fluids, fundamental laws and basic equations of motion applicable to microscopic and macroscopic regimes; treatment of interfacial forces and surfaces in multiphase flow as particularly applied to porous media systems. Prerequisite: Mathematics 343 or Petroleum Engineering 373, or consent of instructor. 3/4 or 1 unit.

Microbiology

(See Life Sciences)

MILITARY SCIENCE

Head of Department: Colonel C. E. CURRAN, JR.

Department Office: 110 Armory

- 100. Leadership Laboratory.** For first semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
- 101. Introduction to Military Science (United States Defense Establishment, I).** An introduction to military life, customs, and organization; achievement of a practical working knowledge of individual weapons and their utilization. Prerequisite: Approval of Professor of Military Science; enrollment in Military Science 100. 1 hour.
- 102. Military Map and Aerial Photograph Analysis.** Fundamentals of military map and aerial photograph reading to include the application of basic principles emphasizing terrain appreciation and evaluation; marginal information; military and topographic map symbols; methods of orientation and resection; military grid reference systems; classes of aerial photography and methods of obtaining the same. Prerequisite: Credit or registration in Military Science 101; approval of Professor of Military Science. 1 hour.
- 103. Introduction to Tactics.** Introduction to the basic principles and fundamentals of tactics and their application in the employment of squad and platoon sized units in offensive and defensive military operations. Prerequisite: Credit or registration in Military Science 101; approval of Professor of Military Science. 1 hour.
- 111. United States Army and National Security (United States Defense Establishment, II).** A survey course in the problems of the United States national defense policy and the role of the United States Army in implementation of that policy. Prerequisite: Approval of Professor of Military Science; registration in Military Science 100 or 125. 1 hour.
- 112. American Military History.** To develop certain basic concepts useful for the study of military history and for the study of current problems of national defense; to give the student a sense of perspective and continuity of the main developments in the history of warfare and the sense of perspective and continuity of the main developments in the history of warfare and the relation of war to society. Discussion of land, sea, and air war through an examination of the relation of strategy and tactics to geography, economics, sociology, and technology through the ages, and through analyzing the relationship between civilians and soldiers in various forms of government; a survey of the main developments in the history of warfare as they have affected American military history; the effects of nuclear weapons on traditional concepts. Prerequisite: Military Science 102 and 103; registration in Military Science 150 or 175. 2 hours.

125. **Leadership Laboratory.** For second semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
150. **Leadership Laboratory.** For first semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
175. **Leadership Laboratory.** For second semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
200. **Leadership Laboratory.** For first semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
201. **Principles of Military Instruction.** An introduction to the principles, methods, and techniques fundamental to military instruction to include lesson planning and presentation, use of training aids, and methods of evaluation. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 1 hour.
202. **Introductory Military Operations (Fundamentals and Dynamics of the Military Team, I).** A course in the application of the principles of offensive and defensive combat as applied to small tactical units; an analysis of the problem of insurgency and the methods used in its containment; methods and means of military communications and their use. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 3 hours.
203. **Principles of Military Leadership.** A course designed to introduce the student to the principles of leadership, the responsibilities and techniques of military leaders, and the problems of leadership in the military environment. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 1 hour.
210. **Military Law and Administrative Management.** An introduction to the fundamental concepts of military justice; the basic principles and methods of courts-martial procedure; principles of nonjudicial punishment; fundamental administrative management. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 1 hour.
211. **Proseminar.** A lecture-discussion course utilizing guest lectures in politico-military and military affairs. Individual research projects and readings are required. A general review of Military Science 102 is included. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 2 hours.
212. **Advanced Military Operations (Fundamentals and Dynamics of the Military Team, II).** An advanced study of military operations and logistics, to include the study of the techniques and functions of commanders and staffs, and the fundamentals of supply and administration of platoons and companies. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 3 hours.
225. **Leadership Laboratory.** For second semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
250. **Leadership Laboratory.** For first semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.
275. **Leadership Laboratory.** For second semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

Mining Engineering

(See Metallurgy and Mining Engineering)

Modern Greek

(See Linguistics)

MUSIC

Director of School of Music: Professor T. FREDRICKSON

School Office: 100 Smith Music Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Thirty-two hours in music, including Music 102, 103, 104, 107, 108, 109, 213, 214, 307, and any two of the following: Music 310, 311, 312, 313, 314, 315, or 317. The remaining six hours are electives, but are normally devoted to the study of a major instrument or the voice. Those insufficiently prepared to enter Music 102 take Music 101 as a deficiency requirement in excess of the total of thirty-two hours credited toward the A.B. degree. At the end of their first year, students in the A.B. curriculum are required to pass the instrumental or vocal qualifying audition held for those outside the School of Music who wish to do work in applied music.

Minors: A minimum of twenty hours from one or two of the following: art, English, and one foreign language, history, philosophy, psychology, rhetoric, speech. At least eight hours must be taken in each subject if two are chosen. No language courses may be regarded as satisfying the minor requirements if they are excluded from the majors of the language departments, with the exception of elementary courses in Greek and Latin, French 103, 104, Italian 103, 104, Spanish 103, 104, German 103, 104, and Russian 204, 206.

Note: Candidates not qualified to enter Music 101 or not able to pass the qualifying examination in piano must reach these standards in excess of the number of hours required for the degree. Applied music courses are selected in conference with the adviser after the student has passed the qualifying examination in his chosen applied music area.

Candidates are advised to elect Physiology 103, Psychology 103, and Philosophy 323 in meeting the general education sequences of the College of Liberal Arts and Sciences, and to continue, if possible, the language started in high school, and to continue language study beyond the requirement of 104.

100. **Rudiments of Theory.** Notation, scales, intervals, chords, terminology. Open to students from other colleges of the University. 2 hours.
101. **Theory of Music, I.** Intensive training in the fundamentals of musicianship, dealing principally with the mechanical aspects of music — clefs, notations, scales, intervals, meters, rhythms, etc. Daily practice in sight singing, melodic, harmonic, and rhythmic dictation, and practice at the keyboard. Prerequisite: For non-music students, Music 100 or equivalent. 3 hours.
102. **Theory of Music, II.** Harmony, counterpoint, and analysis, with emphasis on eighteenth- and nineteenth-century techniques; a study of the basic principles involved in the art of musical composition. Instruction is carried out by means of written assignments, historical examples, individual research problems, and the complete process of writing, preparing, and bringing to performance with voices and instruments specific individual and group projects in musical composition. Prerequisite: Music 101. 3 hours.
103. **Theory of Music, III.** Harmony, counterpoint, and analysis. Prerequisite: Music 102. 3 hours.
104. **Theory of Music, IV.** Harmony, counterpoint, and analysis. Prerequisite: Music 103. 3 hours.
106. **Composition.** Music composition in its beginning and secondary stages. Practice in phrase, sentence and period, analysis, and writing; writing of the shorter forms of music;

- instruction in range, characteristic, and idiom of instruments. Required of Bachelor of Music majors in composition. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 hours (summer session, 2, 3, or 4 hours).
107. **Ear Training, Sight Singing, and Keyboard Harmony, I.** Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 101. 1 hour.
 108. **Ear Training, Sight Singing, and Keyboard Harmony, II.** Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 107. 1 hour.
 109. **Ear Training, Sight Singing, and Keyboard Harmony, III.** Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 108. 1 hour.
 110. **Basic Music Literature.** An introduction to the standard concert repertory through intensive guided listening. Representative works by major composers are chosen to illustrate the principal forms, styles, and techniques of vocal and instrumental music from the time of Bach to the present. Two lectures and two listening hours per week. Required of freshmen in music. 2 hours.
 113. **Appreciation of Music.** Symphonic poems and symphonies. For non-music students. Prerequisite: Sophomore standing. 2 hours.
 115. **Introduction to Opera.** Introduction to the art form, opera; a survey of its musical, dramatic, and stylistic development from the year 1600 to the present. Prerequisite: Sophomore standing. 2 hours.
 130. **Introduction to the Art of Music, I.** This course is designed primarily for the layman to train students in intelligent listening and to acquaint them with many great works of the literature of music. For non-music students only. 4 hours.
 131. **Introduction to the Art of Music, II.** Continuation of Music 130. For non-music students only. Prerequisite: Music 130. 4 hours.
 134. **Afro-American Music.** An introduction to Afro-American music in the United States, past and present, including its African and European origins, its relationship to European music, its social and historical context, and its relationship to Afro-American music elsewhere in the New World. Prerequisite: Music 130 or consent of instructor. 3 hours.
 142. **Elements of Conducting.** The development of basic techniques for conducting instrumental and vocal ensembles. Prerequisite: Sophomore standing in music or consent of instructor. 2 hours.
 150. **Jazz Piano Improvisation, I.** The study of jazz theory, harmony, and improvisational techniques at the piano. Includes experience in solo and ensemble situations, and a historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109 or equivalent; consent of instructor. 2 hours.
 151. **Jazz Piano Improvisation, II.** Continuation of Music 150. The study of jazz theory, harmony, and improvisational techniques at the piano. Includes experience in solo and ensemble situations, and a historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109 or equivalent; consent of instructor. 2 hours.
 160. **Group Instruction in Piano, I.** Beginning group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument. A unified elementary course including the study of simple piano literature and the development of skills in technique, sight reading, harmonization, transposition, improvisation, and analysis. 2 hours.
 161. **Group Instruction in Piano, II.** Elementary group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument. Easy solos from the main periods with appropriate technical development. Continuation of skills introduced in Music 160; introduction of piano ensemble literature. Prerequisite: Music 160 or equivalent; consent of instructor. 2 hours.
 162. **Group Instruction in Piano, III.** Intermediate group instruction in piano for music

majors whose main performing medium is voice or an orchestral or band instrument. Intermediate level solos and ensemble compositions are studied. Harmonization with chromatic chords, sight reading, transposition of four-voice works, improvisation, and learning of patriotic songs. Prerequisite: Music 161 or equivalent; consent of instructor. 2 hours.

163. **Group Instruction in Piano, IV.** Moderately advanced group instruction in piano for music majors whose performing medium is voice or an orchestral or band instrument. A continuation of Music 162 with emphasis on solos, ensemble works, technical development, and more advanced work in sight reading, harmonization, improvisation, transposition, and aural skills. 2 hours.
165. **Class Instruction in Voice.** Group instruction in the fundamentals of singing. For School of Music students who do not major in voice; required of such students in music education. 2 hours.
166. **English Diction.** Phonetics applied to English song literature. Individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
167. **Italian Diction.** Phonetics applied to Italian song literature. Individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
168. **German Diction.** German pronunciation as applied to German vocal literature. Class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.
169. **French Diction.** Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.
170. **String Instruments.** Class instruction in the fundamentals of playing violin, viola, cello, and string bass. Prerequisite: Junior standing in music or consent of instructor. 2 hours.
171. **Clarinet.** 2 hours.
172. **Coronet (or Trumpet).** 2 hours.
173. **Flute and Saxophone.** Prerequisite: Music 171. 2 hours.
174. **French Horn and Percussion.** Prerequisite: Music 172. 2 hours.
175. **Trombone, Baritone, and Tuba.** Prerequisite: Music 172. 2 hours.
176. **Oboe and Bassoon.** Prerequisite: Music 171. 2 hours.

Note: Courses 178 through 198 (applied music) have the following prerequisite: Qualifying examination in performance. The summer credit for each of these courses is 1 or 2 hours.

178. **Guitar.** Private instruction in guitar at the undergraduate level, predominately classical. 2 or 4 hours.
179. **Harpischord.** Private instruction in harpischord at the undergraduate level. 2 or 4 hours.
180. **Piano.** Private instruction in piano at the undergraduate level. 2 or 4 hours.
181. **Voice.** Private instruction in singing at the undergraduate level. 2 or 3 hours.
182. **Organ.** Private instruction in organ at the undergraduate level. 2 or 4 hours.
183. **Violin.** Private instruction in violin at the undergraduate level. 2 or 4 hours.
184. **Viola.** Private instruction in viola at the undergraduate level. 2 or 4 hours.
185. **Cello.** Private instruction in violoncello at the undergraduate level. 2 or 4 hours.
186. **String Bass.** Private instruction in string bass at the undergraduate level. 2 or 4 hours.
187. **Flute.** Private instruction in flute at the undergraduate level. 2 or 4 hours.
188. **Clarinet.** Private instruction in clarinet at the undergraduate level. 2 or 4 hours.
189. **Oboe.** Private instruction in oboe at the undergraduate level. 2 or 4 hours.
190. **Bassoon.** Private instruction in bassoon at the undergraduate level. 2 or 4 hours.
191. **Cornet and Trumpet.** Private instruction in cornet and trumpet at the undergraduate level. 2 or 4 hours.

192. **French Horn.** Private instruction in French horn at the undergraduate level. 2 or 4 hours.
193. **Trombone.** Private instruction in trombone at the undergraduate level. 2 or 4 hours.
194. **Baritone.** Private instruction in baritone at the undergraduate level. 2 or 4 hours.
195. **Tuba.** Private instruction in tuba at the undergraduate level. 2 or 4 hours.
196. **Percussion.** Private instruction in percussion at the undergraduate level. 2 or 4 hours.
197. **Harp.** Private instruction in harp at the undergraduate level. 2 or 4 hours.
198. **Saxophone.** Private instruction in saxophone at the undergraduate level. 2 or 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Instrumentation, I.** Orchestration and arranging for orchestral groups. Prerequisite: Senior standing in music. 2 hours.
201. **Instrumentation, II.** Problems in arranging for all wind instruments. Required of composition majors. Prerequisite: Music 200 or consent of instructor. 2 hours.
213. **The History of Music, I.** A survey of music and its development in Western civilization to 1750. Emphasis is given to an acquaintance with representative musical works and style, and to the understanding of musical concepts in the light of their historical background. Required of all music students. Prerequisite: Music 110 or consent of instructor. 3 hours.
214. **The History of Music, II.** A survey of the development of music as an art in Western civilization from 1750 to the present. Emphasis is given to an acquaintance with formal and stylistic problems through the study of representative works, and an understanding of specific musical concepts in the light of their historical and general cultural context. Required of sophomores in music. Prerequisite: Music 213. 3 hours.
229. **Thesis and Advanced Undergraduate Honors in Music.** Special individual research projects. Required of seniors in the history of music and composition-theory curricula. Open also to advanced undergraduates, including Edmund J. James Scholars, who have achieved University or college honors and who desire to do research in specialized areas of music, including performance. Prerequisite: Senior standing in the history of music and composition-theory, or consent of instructor. 2 hours.
230. **Choral Literature and Conducting, I.** This course is organized on a laboratory basis with a twofold purpose: to survey and study different types of choral literature, and to afford students an opportunity to conduct the group in the singing of choral music suitable for high school groups. Prerequisite: Music 142. 2 hours.
231. **Choral Literature and Conducting, II.** Continuation of Music 230. Prerequisite: Music 230. 2 hours.
232. **Instrumental Literature and Conducting, I.** A survey of music literature for wind ensemble and band. Principles of interpretation and techniques of conducting are emphasized through detailed study and performance of selected compositions. Prerequisite: Music 142. 2 hours.
233. **Instrumental Literature and Conducting, II.** Principles of interpretation and techniques of orchestral conducting are emphasized through detailed study and performance of selected orchestral compositions appropriate for public school groups. Prerequisite: Music 142. 2 hours.
234. **Workshop in Elementary Music Education.** A detailed consideration of music objectives, principles of learning, and their implications for teaching methods. Major emphasis is on techniques and materials suitable for teaching music in the elementary school by the classroom teacher. Specifically designed for the experienced classroom teacher. Prerequisite: Consent of instructor; public school teaching experience. 2 hours. Offered in the summer session only.
240. **Music for Elementary Teachers, I.** A presentation of music for students preparing to teach in the elementary schools. Needed for state elementary school certificate, but not acceptable for credit in the School of Music. Prerequisite: Junior standing in elementary education or consent of instructor. 3 hours.

241. **Music for Elementary Teachers, II.** Continuation of Music 240. A presentation of music for students preparing to teach in the elementary schools. Needed for state elementary school certificate, but not acceptable for credit in the School of Music. Prerequisite: Music 240. 3 hours.
242. **Teaching Music in the Elementary School.** Techniques of and material suitable for teaching music in the elementary school. Prerequisite: Junior standing in music education or consent of instructor. 3 hours.
243. **Teaching Music in the Junior High School.** A detailed consideration of the music program in the junior high school with special emphasis on instructional material and methods of instruction. Prerequisite: Junior standing in music education or consent of instructor. 3 hours.
244. **Teaching of Instrumental Music.** Principles, techniques, organization, and materials for teaching instrumental music in the public school. Prerequisite: Consent of instructor. 2 hours.
245. **Choral Arranging.** Arrangement of suitable materials for choral organizations on the high school level. Prerequisite: Junior standing in music. 2 hours.
246. **Teaching of Choral Music.** Techniques of and materials suitable for organizing and teaching choral music in the public schools. Prerequisite: Junior standing in music education or consent of instructor. 2 hours.
247. **Supervision of School Music.** Designed for those who wish to become supervisors or consultants in music education. Provides an analysis and evaluation of principles, practices, and trends in the supervision of music education in the public schools. Prerequisite: Junior standing in music education or consent of instructor. 2 hours.
248. **Music for Early Childhood Teachers, I.** A course designed to develop musical competencies essential for teachers in nursery schools and kindergartens. Singing, rhythmic keyboard improvisation, creative, and music reading skills are included as well as an extensive study of music materials suitable for use in early childhood music. Prerequisite: Junior standing; child development major. 3 hours.
249. **Music for Early Childhood Teachers, II.** A course designed to further develop the objectives stated in the description for Music 248. Increasing emphasis is placed on individual performance skill and further survey of materials appropriate for use in early childhood music. Prerequisite: Music 248. 3 hours.
250. **University Orchestra.** Prerequisite: Consent of instructor. 1 hour.
251. **Chamber Orchestra.** A chamber orchestra for the purpose of performing literature of all periods written specifically for a chamber-size orchestra. Prerequisite: Consent of instructor. 1 hour.
252. **Wind Ensemble.** Mixed woodwind-brass-percussion ensembles for the study and performance of wind chamber compositions. Prerequisite: Junior standing or consent of instructor. 1 hour.
253. **Collegium Musicum.** Ensemble work in the performance of medieval, Renaissance, and baroque music. Various small groups are formed for the performance of sonatas and canatas of Bach and Handel, wind serenades of Mozart, etc. Interested students may play on viola, lute, harpsicord, and other instruments from the University's collection. Prerequisite: Consent of instructor. 1 hour.
254. **String Ensemble.** The student participates in various ensemble groups, such as trios, quartets, quintets, etc., for the study of chamber music literature. The course may be repeated or taken during the freshman and sophomore year without credit. Prerequisite: Consent of instructor. 1 hour.
255. **Woodwind Ensemble.** Prerequisite: Consent of instructor. 1 hour.
256. **Brass Ensemble.** Ensembles of mixed brasses in both small and large forms. Prerequisite: Consent of instructor. 1 hour.
257. **Percussion Ensemble.** Prerequisite: Consent of instructor. 1 hour.
258. **Piano Ensemble.** Prerequisite: Consent of instructor. 1 hour.

259. **Organ Keyboard Techniques.** Development of practical keyboard skills related to the work of the church organist; transposition, score-reading, harmonization, modulation, hymn-playing, solo and anthem accompaniment. Prerequisite: Consent of instructor. 1 hour.
260. **Oratorio Society.** Performance of oratorios and other major choral works in cooperation with the University Symphony Orchestra. An advanced mixed-voice chorus open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
261. **University Chorus.** Performance of cantatas and other choral works. A mixed-voice chorus for average and beginning singers. Open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
262. **Women's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all women students. Prerequisite: Consent of instructor. 1 hour.
263. **Men's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all men students. Prerequisite: Consent of instructor. 1 hour.
264. **University Choir.** Practical experience in mixed-voice singing of accompanied and unaccompanied music of various periods and styles. A highly advanced group of competent student singers. Prerequisite: Consent of instructor. 1 hour.
265. **Opera Workshop and Ensemble.** Preparation and public performance of grand or light opera; covers the music and acting only. Students desiring experience in costuming, stage management, scenery, publicity, etc., should apply to the University Theatre which cooperates in the opera productions. Admission is by audition. Prerequisite: Consent of instructor. 1 hour.
266. **Jazz Band.** Designed to acquaint proficient instrumentalists with jazz compositions, arrangements, and improvisational procedures, and to promote a high degree of stylistic and technical competence in performance. Prerequisite: Consent of instructor, determined by auditions. 1 hour.
267. **Harp Ensemble.** Ensembles of multiple harps and harp in combination with other instruments. Prerequisite: Consent of instructor or Music 197 and/or 397. 1 hour.
268. **Small Choral Ensembles.** Open to a limited number of undergraduate students who desire experience in performance of music specifically written for smaller choral groups. Membership through audition only. Prerequisite: Consent of instructor. 1 hour.
269. **Music Convocations and Concerts.** Weekly programs of cultural enrichment as they relate to the programs of study for undergraduate and graduate students in music. No credit.
300. **Eighteenth-Century Counterpoint.** The study of the technique of contrapuntal writing as found in the works of J. S. Bach and other eighteenth-century composers. Imitation, canon, invertible counterpoint, two- and three-part inventions, etc., are studied through writing and analysis of compositions by eighteenth-century composers. Prerequisite: Music 104 and/or consent of instructor. 3 hours or 1/2 unit.
301. **Fugue.** The study of fugal writing during the eighteenth and early nineteenth centuries. A continuation of the study of tonal counterpoint begun in Music 300, with special emphasis on the study and analysis of the fugal works of J. S. Bach, Handel, and Beethoven, and on the writing of fugues and parts fugues. Prerequisite: Music 300 and/or consent of instructor. 3 hours or 1/2 unit.
302. **Musical Acoustics, I.** History of music, science, and technology; introduction to sets and functions; definition of acoustical parameters: frequency (pitch), amplitude (loudness), spectrum (sound quality); measurement of decibel level and frequency response; harmonic spectrum analysis; sound perception; acoustic waves; acoustics of string, wind, and percussion instruments. Prerequisite: Mathematics 111, 112, or 118, or equivalent. 3 hours or 3/4 unit.
303. **Musical Acoustics, II.** Acoustics of the voice; speech formants. Intervals, scales, tuning, and temperament; auditorium and room acoustics; microphones and loudspeakers,

electronic sound reinforcement, feedback problems; Sound recording and reproduction; Sound analysis and synthesis by computer. Prerequisite: Music 302. 3 hours or 3/4 unit.

304. **Contemporary Compositional Techniques.** Studies in specialized areas of composition for advanced undergraduates and graduates majoring in composition-theory. May be elected by others with consent of instructor. Prerequisite: Music 104, 106, or 109, or consent of instructor. 2 hours or 1/2 unit.
306. **Composition.** Work in original composition including the small and large homophonic forms. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 to 4 hours, or 1/2 or 1 unit.
307. **Counterpoint of the Fifteenth and Sixteenth Centuries.** Analysis and writing in the principal contrapuntal styles of the fifteenth and sixteenth centuries. The course, through study and singing, seeks familiarization with the styles of Dunstable, Dufay, Obrecht, Okeghem, Gombert, Des Pres, Lassus and Palestrina. Writing is based on the results of the study of these composers' works. Prerequisite: Junior standing in music or consent of instructor. 2 hours or 1/2 unit. Offered in 1973-1974 and in alternate years.
308. **Analysis of Musical Form.** An intensive study of representative compositions of the sixteenth through the twentieth centuries for structure and form. Prerequisite: Music 104 and 109, or consent of instructor. 3 hours or 1/2 unit.
309. **Electronic Music Techniques.** Introduction to use of electronic music studios; aesthetics of sound composition and compositional techniques. System theory; "classical" sound synthesis and tape manipulation techniques; concept of voltage control and use of voltage-controlled synthesizers; techniques for interaction of live sounds with electronics; notational problems. Tape composition studies are assigned. Prerequisite: Credit or registration in Music 302. 3 hours or 3/4 unit.
310. **Ancient Medieval Music.** A history of music from its origins to about 1400. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
311. **Music in the Renaissance.** A history of music from about 1400 to 1600. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
312. **Music of the Seventeenth Century.** A history of music from about 1600 to 1700. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
313. **Music of the Eighteenth Century.** A history of music from about 1700 to 1800. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
314. **Music of the Nineteenth Century.** A history of music from about 1800 to 1900. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
315. **Music of the Twentieth Century.** A history of music from about 1900 to the present. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or 1/2 unit.
316. **Introduction to Music of the World's Cultures.** Same as Anthropology 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to methods of collecting and studying music in non-literate, folk, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours or 1/2 unit.
317. **Area Studies in Ethnomusicology.** Same as Anthropology 315. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or 1/2 unit. Maximum accumulated credit, 12 hours or 2 units.
318. **History of Performance Practices, I.** The study of musical performance from about 900 to 1650 A.D. Discussion of musical instruments, makeup of instrumental and vocal ensembles, etc., is supplemented by demonstration performances of selected works using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history or consent of instructor. 3 hours or 1/2 unit.
319. **History of Performance Practices, II.** The study of musical performance from 1600 to 1750 A.D. Discussion of musical instruments, ornamentation, basso continuo, etc., is supplemented by demonstration performances using the University's collection of instru-

ments. Prerequisite: Senior standing in music theory and music history or consent of instructor. 3 hours or 1/2 unit.

320. **Proseminar.** A course providing special preparation in specialized fields of musicology, theory and composition, and music education. Prerequisite: Senior or graduate standing in music or music education; consent of instructor. 2 or 4 hours, or 1/2 or 1 unit. Credit may be accumulated to a maximum of 8 hours or 2 units.
321. **Proseminar in Musicology.** A practical introduction to research in musicology, devoted each time to intensive study of a selected topic, including use of primary source materials, lectures, and reports. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit. May be repeated to a total of 2 units.
323. **Opera Production, I.** The course is designed to help interested students on the graduate level study the problems of the lyric stage. Casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics are investigated and practiced. Prerequisite: Music 265 and 381; consent of instructor. 3 hours or 1/2 unit.
324. **Opera Production, II.** The course is designed to help interested students on the graduate level study the problems of the lyric stage. Casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics are investigated and practiced. Prerequisite: Music 323. 3 hours or 1/2 unit.
325. **Introduction to Musicology, I.** A survey of the discipline of musicology, its scope, and its history with bibliographical studies and sample problems for investigation. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or 1/2 unit).
326. **Introduction to Musicology, II.** Continuation of a survey of the discipline of music. Special attention is given to class projects in systematic musicology and to the philosophy of music history. Prerequisite: Music 325 or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or 1/2 unit).
329. **History of Musical Instruments.** The evolution of instruments, both Western and non-Western, considered in their social and cultural settings; construction and playing techniques of instruments treated in relation to performance practice and stylistic developments. Prerequisite: Music 213 or 214, or consent of instructor. 3 hours or 1/2 unit.
330. **Applied Music Pedagogy.** A survey of techniques, practices, and materials. Presentation of group and individual instruction; an approach to teaching problems, tone production, musical styles, and interpretation for various age levels; actual teaching experience under faculty supervision. Required of applied music majors in piano, voice, and string instruments. Prerequisite: Junior standing in music or consent of instructor. 2 hours or 1/2 unit. Credit may be accumulated to a maximum of 4 hours or 1 unit.
332. **Church Music Literature.** Survey of the development of church music with emphasis on the period since 1500. Prerequisite: Music 214 or 311, or consent of instructor. 2 hours or 1/2 unit. Offered in 1972-1973 and in alternate years.
333. **Church Music Techniques.** A course dealing with the technical problems of the church musician; chanting, liturgical practices, organization, repertoire. Prerequisite: Music 332 or consent of instructor. 2 hours or 1/2 unit. Offered in 1972-1973 and in alternate years.
334. **The Music of America, I.** A study of folk, popular, and art music in America from the time of the first European settlers through the middle of the nineteenth century; psalmody, early opera, and concert life, African and European folk music, the singing school, music of European immigrants, and the roots of jazz. Prerequisite: Senior standing in music or consent of instructor. 3 hours or 1/2 unit.
335. **The Music of America, II.** A study of chamber, choral, and orchestral music written by American composers from 1850 to the present; jazz and its offshoots; folk and popular music; and experimental music in America. Prerequisite: Senior standing in music or consent of instructor. 3 hours or 1/2 unit.
336. **Music in Latin America.** Studies in the history of music in Latin America from colonial times to the present, including its cultural and social background. Each semester is

devoted to a specific area, e.g., Caribbean America and Venezuela, Colombia and the Andean nations, Brazil and the River Plate nations. A reading knowledge of Spanish or Portuguese is recommended. Prerequisite: Junior standing or consent of instructor. 3 hours or 1/2 unit. Maximum accumulated credit, 6 hours or 1 unit.

- 340. Instrumental Clinic and Band Pageantry.** A study of the peculiarities of the individual instruments, criteria for selection, and accepted teaching methods and procedures for each instrument. Band pageantry deals with formation designing, charting, and show continuity, marching fundamentals, and special problems. Prerequisite: Advanced undergraduate or graduate with major work or experience in band or orchestra. 2 hours or 1/2 unit.
- 341. Advanced Instrumental Administration.** Administration of bands and orchestras in public schools and college. Prerequisite: Advanced undergraduate or graduate with major work or experience in band or orchestra. 4 hours or 1 unit.
- 342. Percussion Methods.** Designed primarily for teachers of school music who may or may not be percussion performers, but who wish to teach percussion and initiate such a program in the schools. Prerequisite: Senior or graduate standing in music education and Music 174 and 257 or equivalent. 3 hours or 1/2 unit.
- 343. Tests and Measurement in Music Education.** Construction, design, appraisal, and use of measurement devices for music teaching and research. Prerequisite: Consent of instructor. 2 or 4 hours, or 1/2 or 1 unit.
- 344. Methods of String Class Teaching.** This course is designed primarily for teachers of school music who are not performers on a stringed instrument yet would like to be able to teach string classes and start an orchestral program in the schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or 1/2 unit. Offered in the summer session only.
- 345. Teaching Techniques of Music Theory.** Teaching materials, methods, texts, and pedagogical sequence are discussed and analyzed, including an intensive survey of the structural materials normally covered during the first two years of collegiate study. Prerequisite: Music 300 or consent of instructor. 2 hours or 1/2 unit.
- 346. Workshop in Music Education.** Workshop designed to develop essential facts, attitudes, and principles through a consideration of problems encountered in music education. Parallel with this study is the preparation of resource materials for music programs in elementary and secondary schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 to 4 hours, or 1/2 or 1 unit. Credit may be accumulated to a maximum of 2 units. Offered in the summer session only.
- 347. Teaching of Woodwind Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or 1/2 unit. Offered in the summer session of 1972 and in alternate years.
- 348. Teaching of Brass Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or 1/2 unit. Offered in the summer session of 1972 and in alternate years.
- 349. Music in Early Childhood.** Same as Home Economics 349. A detailed consideration of the music program in nursery schools, kindergarten, and the primary grades. Topics covered include the nature of early musical responses, objectives, and experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate level in music education or child development. 2 hours or 1/2 unit.
- 350. Advanced Ensemble Music.** Selected projects in the study and performance of ensemble literature, including the areas of operatic, instrumental, and vocal-choral music and accompanying. Prerequisite: Registration in applied music at the 300 level and consent of instructor. 2 hours or 1/2 unit (summer session, 1 hour or 1/4 unit).
- 360. Advanced Group Instruction in Piano, I.** A comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: sight

reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (twelve hours completed) or Music 163, and Music 104 and 109, or equivalent; consent of instructor. 2 hours or 1/2 unit.

361. **Advanced Group Instruction in Piano, II.** Continuation of Music 360. A comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: Sight reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (twelve hours completed) or Music 163, Music 104 and 109 or equivalent, Music 360 or equivalent and consent of instructor. 2 hours or 1/2 unit.
366. **Vocal Repertoire, I.** To be taken with Music 381. A study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio and opera. The purpose of this study is to supplement the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice or consent of instructor. 1 hour.
367. **Vocal Repertoire, II.** To be taken with Music 381. A study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera. The purposes of this study is to supplement the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice; consent of instructor. 1 hour.

Note: Courses 378 through 398 (applied music) have the following prerequisite: For students in the Bachelor of Music curriculum, junior standing in the major applied music subject. For students in music education, completion of the curricular requirement in the major applied music subject. For students in other colleges of the University, completion of four semesters in comparable applied music course at the 100 level.

378. **Guitar.** Private instruction in guitar on the advanced undergraduate and graduate levels, predominately classical. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
379. **Harpischord.** Private instruction in harpischord on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
380. **Piano.** Private instruction in piano on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
381. **Voice.** Private instruction in singing on the advanced undergraduate and graduate level. 2 or 3 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
382. **Organ.** Private instruction in organ on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
383. **Violin.** Private instruction in violin on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
384. **Viola.** Private instruction in viola on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
385. **Cello.** Private instruction in violoncello on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
386. **String Bass.** Private instruction in string bass on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
387. **Flute.** Private instruction in flute on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
388. **Clarinet.** Private instruction in clarinet on the advanced undergraduate and graduate level. 2 or 4 hours or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
389. **Oboe.** Private instruction in oboe on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
390. **Bassoon.** Private instruction in bassoon on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
391. **Cornet and Trumpet.** Private instruction in cornet and trumpet on the advanced

undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).

392. **French Horn.** Private instruction in French horn on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
393. **Trombone.** Private instruction in trombone on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
394. **Baritone.** Private instruction in baritone on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
395. **Tuba.** Private instruction in tuba on the advanced undergraduate and graduate level. 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
396. **Percussion.** Private instruction in percussion on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
397. **Harp.** Private instruction in harp on the advanced undergraduate and graduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
398. **Saxophone.** Private instruction in alto saxophone on the advanced undergraduate level. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit).
400. **Advanced Instrumentation: Chamber and Symphonic.** Orchestrate for chamber and symphony orchestras; works of classical, romantic, and modern composers. Prerequisite: Undergraduate instrumentation. 1/2 or 1 unit.
401. **Advanced Instrumentation: Band.** Arrange for the concert band, works from orchestra, organ, and chamber music by composers of the classical, romantic, and modern periods. Prerequisite: Undergraduate instrumentation. 1/2 or 1 unit.
402. **Analysis in Relation to Performance and Interpretation, I.** A unifying course in the structure of music, in which analysis is related to the performance and understanding of music. Course material drawn from standard literature from the Renaissance to the present day with emphasis on the smaller forms. Prerequisite: Music 104 or equivalent; consent of instructor. 1 unit.
406. **Composition.** Advanced study of contrapuntal forms; study of contemporary melodic and harmonic practices; original work in advanced composition. 1/2 to 1 1/2 units.
410. **History of Music Theory.** Prerequisite: Graduate standing in musicology or composition or consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
411. **Introduction to Ethnomusicology.** A comprehensive survey of concepts, problems, and methods of research in non-Western and folk music. Prerequisite: Graduate standing in musicology or consent of instructor. 1 unit.
412. **History of Musical Aesthetics, I.** A survey of the principal philosophies of music, their historical backgrounds, and their relation to musical styles. From Pythagoreanism to the humanistic period. Prerequisite: Graduate standing in music. 1/2 or 1 unit. Offered in 1973-1974 and in alternate years.
413. **History of Musical Aesthetics, II.** A survey of the principal philosophies of music, their historical backgrounds, and their relation to musical styles from the seventeenth century to the present day. Prerequisite: Music 412. 1/2 or 1 unit. Offered in 1973-1974 and in alternate years.
414. **Notation, I.** The history of notation from its beginning to 1400. Prerequisite: Consent of instructor. 1/2 unit.
415. **Notation, II.** The history of notation from 1400 to 1600, including instrumental tabatures. Prerequisite: Music 414 or consent of instructor. 1/2 unit.
417. **History of Instrumental Music from 1600 to 1750.** A study of instrumental music in the Baroque era. Prerequisite: Music 416 or consent of instructor. 1/2 or 1 unit. Offered in 1973-1974 and in alternate years.
418. **The Origins and the History of Opera up to Gluck.** The antecedents of opera in the sixteenth century; social, cultural, intellectual forces leading to its development; study of scores, librettos, scenography; readings on performance practices, theory, and aes-

thetics of opera. The principal composers covered are Monteverdi, Cavilli, Cesti, Lully, Rameau, Blow, Purcell, Scarlatti, Handel, Gluck. 1/2 or 1 unit. Prerequisite: Music 312 or consent of instructor.

419. **The History of Opera from Mozart to the Present.** A detailed examination of stylistic and structural developments in opera after Gluck, with special reference to representative works from Mozart to Schoenberg viewed in relation to the general musical and cultural background of their time and place of origin. Prerequisite: Music 312 and 313, or consent of instructor. 1/2 or 1 unit.
420. **Seminar in Music Literature.** Intensive study of outstanding works selected from all fields of music literature. Required of all students (except those in choral music) enrolled in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
421. **Research in Music Education.** An introduction to problems and methods of research in music education. Required of all candidates for the Doctor of Education in music education. Prerequisite: Graduate standing in music education or consent of instructor. 1 unit.
422. **Seminar in Theory of Music.** Intensive study of selected topics in the fields of music theory, history of theory, and history of musical materials. Prerequisite: Graduate standing in music theory or consent of instructor. 1/2 or 1 unit.
423. **Seminar in Musicology.** Problems in historical and systematic musicology; discussions of special problems and reports on individual research. Prerequisite: Graduate standing in musicology and Music 321, or consent of instructor. 1 unit.
424. **Seminar in the Works of a Selected Composer.** A seminar devoted to intensive historical and analytical study of the works of important composers. Each semester is devoted to one composer, e.g., Bach, Beethoven, Handel, Haydn, Mozart, Wagner, etc. Prerequisite: Music 213 and 214; two of the following: Music 310, 311, 312, 313, 315, or equivalent. 1 unit (summer session, 1/2 unit). May be repeated for a maximum of 2 units.
425. **Readings in Musicology.** Individual guidance in intensive readings in the literature of one or more subdivisions of the field of musicology, selected in consultation with the instructor and in accordance with the needs and interests of the student. Prerequisite: Graduate standing in musicology, and consent of instructor. 1/2 or 1 unit (summer session, 1/2 unit).
428. **Problems and Methods.** An introduction to methods in research and stylistic criticism and to bibliographic aids, editions and editing of music, as related to the work of the musician and composer. Reports of bibliographic problems and on individual projects are presented orally and in writing. Required of all students in the Master of Music program, except those majoring in musicology. 1 unit.
429. **Historical Studies in Twentieth-Century Music.** A seminar in contemporary music, with emphasis on the historical foundations of current trends in musical composition. Prerequisite: Music 315 or 422, or equivalent. 1/2 to 1 unit. Maximum accumulated credit, 2 units.
430. **Advanced Orchestra Conducting and Literature.** Intensive study of conducting techniques and problems related to standard orchestral literature. Includes a survey of materials for school and community orchestra. Prerequisite: Previous conducting experience. 1 unit.
431. **Advanced Band Conducting and Literature.** Study of problems and techniques of band conducting and a survey of literature for the concert band. Prerequisite: Bachelor's degree with major work or experience in band and/or orchestra; consent of instructor. 1 unit.
432. **Advanced Choral Techniques.** An intensive laboratory approach to the development of advanced techniques necessary for working effectively with choral ensembles. Prerequisite: Graduate standing in music. 1 unit.
433. **Advanced Choral Literature and Conducting.** An intensive survey of choral literature with laboratory organization for reading, conducting, and interpretation of choral music

- of all periods, styles, and voice arrangements. Prerequisite: Graduate standing in music education, Music 432 or equivalent, or consent of instructor. 1 unit.
- 434. Piano Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
- 435. Vocal Literature.** Study of solo song in larger works, and solo art song. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
- 436. Organ Literature.** An intensive study of organ literature from Bach to the present. The material includes the music itself, recordings, and collateral readings. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
- 437. String Instrument Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
- 438. Wind Instrument Literature.** An integrating course offering the opportunity to survey at the graduate level the field of solo and ensemble wind literature. The material includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. 1 unit. Maximum accumulated credit, 2 units.
- 439. Percussion Instruments Literature.** An integrating course offering the opportunity to survey and analyze the field of solo and ensemble percussion literature. The material includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. Prerequisite: Graduate standing in music; consent of instructor. 1 unit. Maximum accumulated credit, 2 units.
- 440. Foundations and Principles of Music Education, I.** A consideration of the historical and philosophical foundations of music education; the application of the principles of education to the music program. Major emphasis is placed on current trends in educational thought and their implications for music education. Prerequisite: Graduate standing in music education; consent of instructor. 1/2 or 1 unit.
- 441. Foundations and Principles of Music Education, II.** A consideration of the psychological foundations of music education; the application of the principles of education to the music program. Major emphasis is placed on current trends in educational thought and their implications for instruction, supervision, administration, and evaluation in music education. Prerequisite: Graduate standing in music education; consent of instructor. 1/2 or 1 unit.
- 442. The General Music Program in Secondary Schools.** A detailed consideration of the general music program, its objectives, organization, and operation. Special attention is given to materials and methods of teaching. Prerequisite: Graduate standing in music education. 1/2 or 1 unit.
- 443. Administration and Supervision of Music Education.** Deals with the functions of supervisors and directors of music education in administering music programs in elementary and secondary schools. Prerequisite: Graduate standing in music or music education. 1/2 or 1 unit.
- 444. The General Music Program in Elementary Schools.** A detailed consideration of elementary general music, its objectives, organization, operation. Special attention is given to materials and methods of teaching. Prerequisite: Graduate standing in music education. 1/2 unit.
- 445. Music in Higher Education.** An orientation to the organization, teaching, and administration of music in the college and university. Prerequisite: Graduate standing in music or music education. 1/2 or 1 unit.
- 446. Seminar in Experimental Music, I.** Survey of contemporary electronic music, computer music and related types of music. Discussion of relevant music theory. Prerequisite: Music 303 or consent of instructor. 1/2 unit.
- 447. Seminar in Experimental Music, II.** Continuation of Music 446. Prerequisite: Music 446 or consent of instructor. 1/2 unit.

448. **Computer Music.** Representation of sound signals in a digital computer; methods for input and output of sounds to and from a computer; sound synthesis programs; synthesis of simple musical structures; use of graphics; processing of live sounds by computer; editing and retrieval; fidelity of computer-produced sounds; hybrid analog/digital computers. Prerequisite: Music 302 or equivalent; registration in Computer Science 101 or equivalent. 1/2 unit.
450. **History of Vocal Ensemble and Choral Music, I.** A critical and analytic study of vocal and choral ensemble music from the Middle Ages to 1750. 1 unit (summer session, 1/2 unit).
451. **History of Vocal Ensemble and Choral Music, II.** A critical and analytic study of vocal and choral ensemble music from 1750 to the present. 1 unit (summer session, 1/2 unit).
480. **Piano.** Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
481. **Voice.** Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
482. **Organ.** Selected studies from the masterworks of organ literature. Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
483. **String Instruments.** Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
484. **Wind Instruments.** Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
485. **Percussion Instruments.** Prerequisite: Bachelor of Music; successful completion of a qualifying examination given by the graduate committee. 1/2 or 1 unit.
489. **Doctoral Projects.** Special projects for candidates for the Doctor of Musical Arts. Open only to students in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 1 to 3 units.
499. **Thesis Research.** Research in special projects. Prerequisite: Consent of instructor. 0 to 4 units.

NAVAL SCIENCE

Head of Department: Colonel T. D. JOHNSON

Department Office: 239 Armory

100. **Naval Science Laboratory.** A non-credit course designed to give the Naval ROTC student, through practical application, a better grasp of the naval science subjects taught in the classroom and a working knowledge of close order drill. 0 credit.
111. **Principles of Naval Organization and Management.** Naval organization and management practices are examined within the context of American social and industrial organization and practice. Includes command and control, organization for logistics, service and support, functions and services of major components of the Navy and Marine Corps, and shipboard organization. Emphasis is on management and leadership functions. Prerequisite: Approval of Professor of Naval Science; registration in Naval Science 100. 3 hours.
112. **Introduction to Naval Ship Systems.** A study of ship compartmentation, propulsion systems, auxiliary power systems, interior communications, and ship control. Included are types, structure, and purpose of naval ships. Elements of ship design and ship stability are examined. Prerequisite: Naval Science 111 or consent of instructor. 3 hours.
122. **American Military Affairs.** An introductory survey of military affairs in the United States from the American Revolution to the present. Emphasis is placed on the evolution

of the American military establishment and international and domestic considerations leading to American involvement in international conflicts. Prerequisite: Sophomore standing in Naval ROTC or consent of instructor. 3 hours.

231. **Navigation and Naval Operations, I.** Acquaints the student with the techniques and procedures involved in naval ship control, including piloting, rules of the nautical road, naval formations and dispositions, and principles of relative motion. Prerequisite: Junior standing in Naval ROTC or consent of instructor. 3 hours.
232. **Navigation and Naval Operations, II.** Designed to give the student an understanding of the theory and technique of navigation and the knowledge of celestial navigation of ships and aircrafts; to introduce the student to operations analysis and naval communications, fleet operations, and organization. Prerequisite: Junior standing in Naval ROTC or consent of instructor. 3 hours.
241. **Naval Weapons Systems.** Introduction to the concept of weapons systems and the linear analysis of ballistics and weapons. Prerequisite: Senior standing in naval officer training program; registration in Naval Science 100. 3 hours.
242. **Naval Management.** Explores the sociological structure of the military and the management practices essential to the effective functioning of the organization. Stresses the junior manager's role in this complex and in its operations. Prerequisite: Senior standing in Naval ROTC or consent of instructor. 3 hours.
291. **Evolution of Warfare.** A survey of the evolution of warfare. Emphasis is placed on the philosophies and trends which have been significant in land warfare. Prerequisite: Advanced undergraduate standing; registration in Naval Science 100 or consent of instructor. 3 hours.
293. **History of Amphibious Warfare.** Study of amphibious operations and the evolution of amphibious warfare doctrine and development. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.

NUCLEAR ENGINEERING

Chairman of Nuclear Engineering Program: Professor M. E. WYMAN

Program Office: 214 Nuclear Engineering Laboratory

The Nuclear Engineering Program offers work leading to the Master of Science and Doctor of Philosophy in Nuclear Engineering and provides courses and research facilities for doctoral candidates in nuclear engineering and related fields.

The programs in nuclear engineering are open to all graduates in engineering, mathematics, and the physical sciences who have a grade-point average of at least 4.0 out of 5.0 for the last two years of undergraduate work. Students with grade-point averages below 4.0 but above 3.5 are considered individually. Applicants who fall in this latter category are invited to support their application with a letter explaining the circumstances. It is recommended that they also submit letters of reference and information as to their rank in class.

Undergraduate courses in differential equations, advanced calculus, and atomic physics are required as background for the nuclear engineering program. A student may be admitted before he has completed these three prerequisites; but he must then allow an additional semester or summer of study for the completion of the master's degree.

In addition to the graduate course in nuclear engineering, an introductory course, Nuclear Engineering 347, is offered for all interested advanced undergraduates in engineering or science. For those interested in tracer techniques, or health physics and radiation protection, Nuclear Engineering 349, 397, and 398 are offered at the advanced undergraduate level. Students interested in a single survey of the field should consider Nuclear Engineering 302, Nuclear Power Engineering.

For further information see the booklet *Graduate Program in Nuclear Engineering* available from the Nuclear Engineering Office, 214 Nuclear Engineering Laboratory.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
302. **Nuclear Power Engineering.** Same as Mechanical Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering, including such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
312. **Nuclear Power Economics and Fuel Management.** A quantitative analysis of the economic impact of the nuclear power industry; nuclear fuel cycle and capital costs for thermal and fast reactors; optimization of the use of nuclear fuels to provide the lowest energy costs and highest system performance; comparison between fossil fuel systems, fission systems, and controlled thermonuclear systems. Prerequisite: Junior standing, Mechanical Engineering or Nuclear Engineering 302, or Nuclear Engineering 347, or consent of instructor. 3 hours or 1 unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems. Energy balance; plasma confinement and stability; recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.
347. **Introduction to Nuclear Engineering.** Nuclear particles and nuclear chain reactions; energy release from fission; classification of nuclear reactors; fast and thermal reactors; reactor theory; slowing down and diffusion of neutrons; radiation shielding; materials of construction, radiation damage; reactor instrumentation, safety, and control; chemical processing of nuclear materials. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent. 4 hours or 1 unit.
349. **Fundamentals of Radiation Protection.** Same as Civil Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry; sources of ionizing radiation; determination of radiation tolerances; dosimetric instruments; standards and regulations. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382. 4 hours or 1 unit.
357. **Nuclear Reactor Safeguards.** Safety problems related to nuclear systems; emphasis on problems concerning nuclear reactors; past nuclear accidents and future prevention, selection of sites, containment of radioactivity, engineered safeguards, safety analysis of operation, legal responsibilities, and public relations. Prerequisite: Junior standing; Nuclear Engineering 302 or Nuclear Engineering 347, or consent of instructor. 3 hours or 1 unit.
388. **Nuclear Ceramics.** Same as Ceramic Engineering 388. A study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor. Material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in non-fissile ceramics, nuclear carbon and graphite and non-fuel ceramic isotope utilization are discussed. Prerequisite: Chemistry 245, Physics 383, or consent of instructor. 3 hours or 1 unit.
397. **Radiochemistry.** Same as Chemistry 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or 3/4 unit.
398. **Radiochemistry Laboratory.** Same as Chemistry 398. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. One laboratory and one discussion period per week. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 2 hours or 1/2 unit.
401. **Fundamentals of Nuclear Engineering.** A lecture and problem course to provide background for further work in nuclear engineering. Problems in materials, heat transfer, and fluid flow. Special emphasis is given to basic ideas and the mathematical similarity

of problems in heat transfer, fluid flow, and neutron diffusion. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent; credit in Mathematics 345 or equivalent. 1 unit.

411. **Nuclear Reactor Heat Transfer.** Selected topics in nuclear reactor heat transfer: thermal analysis of fuel elements under steady and transient operation, convective energy transport from reactor cores, two-phase flow and boiling in reactor cores, and liquid metal coolant systems. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
421. **Nuclear Concepts.** Selected topics in low-energy nuclear physics of general interest to the nuclear engineering fields; nuclear reactions, cross sections, slowing down and interactions with matter, decay theory, and nuclear forces. Prerequisite: Credit in a nuclear physics course such as Nuclear Engineering 397 or Physics 382. 1 unit.
422. **Controlled Fusion Systems.** Same as Electrical Engineering 422. Development of plasma models for fusion analysis; treatment of plasma heating and confinement with applications to current experiments; energy balances and energy extraction, minimum-B configuration, instability criteria, Tokamak machines, pinch systems, mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
425. **Nuclear-Electrical Energy Conversion.** Same as Electrical Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection; analysis and applications of direct collection of charged particles; radiation induced ionization and excitation theory and applications. 1 unit.
431. **Nuclear Metallurgy.** Metallurgical principles applied to materials problems in nuclear engineering, including topics in production of uranium, corrosion, radiation damage, fuel element fabrication, and fuel reprocessing. Prerequisite: Consent of instructor. 1 unit.
441. **Nuclear Radiation Shielding.** Radiation units and measurement; tolerance limits; interaction of radiation and matter; geometry factors in attenuation; gamma ray and neutron attenuation; moment theory for attenuation; application to reactors, protective shelters, and space vehicles. Prerequisite: Nuclear Engineering 349; credit or registration in Nuclear Engineering 455; consent of instructor. 1 unit.
447. **Radioactive Waste Disposal.** Same as Civil Engineering 447. Sources and characteristics of radioactive wastes; methods of treatment; ultimate disposal; fate of radioisotopes in the environment; permissible levels in air and water; current levels in water supplies; water treatment methods; monitoring techniques; solid waste disposal; gaseous waste disposal; air monitoring; and reactor site selection and hazards evaluation. Prerequisite: Nuclear Engineering 398 or consent of instructor. 1/2 or 1 unit.
451. **Reactor Laboratory.** Reactor operation: start-up, changes in power level, and shut-down. Reactor instrumentation: subcritical assemblies; flux measurements in core and thermal column; control rod worth measurements; effects of changes in fuel configurations; activation and neutron beam experiments. Prerequisite: Nuclear Engineering 347 or consent of instructor. 1/2 or 1 unit.
454. **Nuclear Engineering Laboratory Investigations.** Individual laboratory investigations in nuclear engineering. Prerequisite: Consent of instructor. 1/4 to 2 units.
455. **Reactor Physics, I.** Same as Physics 455. An introduction to the physical concepts of reactor analysis; nuclear cross sections; diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; computer applications in reactor analysis. Prerequisite: Mathematics 343 and 345, Nuclear Engineering 347, or consent of instructor. 1 unit.
456. **Reactor Physics, II.** Same as Physics 456. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; digital computer methods. Prerequisite: Nuclear Engineering 455 or consent of instructor. 1 unit.
457. **Methods of Fast Reactor Analysis.** Static and dynamic performance characteristics of fast reactors. Multigroup diffusion and transport models for fast power reactors; construction of multigroup cross-section sets; algorithms for one-dimensional and multidimensional problems in heat transfer, fluid flow, and neutron diffusion. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent; credit in Mathematics 345 or equivalent. 1 unit.

mensional numerical analysis; reactivity coefficients; fast reactor safety and reliability. Prerequisite: Nuclear Engineering 455. 1 unit.

458. **Nuclear Reactor Engineering.** Development of engineering design phases of the fission chain reactor: reactor materials and radiations, thermal aspects, heat removal, radiation hazards, shielding, reactor performance, controls and instrumentation, types and applications, fuel conversion, reactor power economics. Prerequisite: Nuclear Engineering 347 or consent of instructor. 1 unit.
460. **Reactor Kinetics.** Discussion of special topics such as response of reactor systems to changes of power demand and reactivity. Transfer function analysis, nonlinear problems of reactor dynamics, reactor stability; fuel cycles; digital and analog computer methods for solving reactor kinetic problems. Prerequisite: Nuclear Engineering 401; credit or registration in Nuclear Engineering 455; consent of instructor. 1 unit.
467. **Thermomechanics of Nuclear Reactor Systems.** Same as Theoretical and Applied Mechanics 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal shock and thermal stress-wave propagation; current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
490. **Special Topics.** Selected areas are considered which are of current interest in research, such as nuclear materials, advanced reactor systems, thermonuclear problems, digital computer methods in nuclear engineering, advanced topics in reactor theory. Prerequisite: Consent of instructor. 1/2 or 1 unit.
495. **Nuclear Engineering Problems.** Individual study in areas of nuclear engineering and closely related fields not covered by regular course offerings. The work is carried out under the supervision of a member of the staff. Prerequisite: At least three units of graduate work; consent of instructor. 1/4 to 2 units.
497. **Seminar in Nuclear Science and Engineering.** Lectures and discussions on current work in research and development in nuclear engineering and related fields by staff, advanced students, and visiting lecturers. 0 credit.
499. **Thesis Research.** 0 to 4 units.

NUTRITIONAL SCIENCES

Chairman of Committee on Nutritional Sciences: Professor H. H. DRAPER

Nutritional Sciences Program Office: 567 Bevier Hall

400. **Nutritional Sciences Seminar.** Discussions on current problems in nutritional sciences. Required of all graduate students in the nutritional sciences program. 1/4 unit. Prerequisite: Animal Science 420.
499. **Thesis Research.** 0 to 4 units. (summer session, 0 to 2 units).

Additional courses offered in this program are described under departmental listings: Animal Science 420, Comparative Nutrition; Animal Science 421, Topics in Nutritional Biochemistry; Dairy Science or Animal Science 481, Animal Biochemical Laboratory Techniques; Food Science or Home Economics 324, Problems in Nutrition.

OCCUPATIONAL THERAPY

Office: 1115 West Oregon Street, Urbana

100. **Occupational Therapy Orientation.** History and development of professional aspects of occupational therapy; its scope and relation to applied professions; its function in the

field of physical and mental adjustment. Prerequisite: Registration in occupational therapy curriculum. 2 hours. DUNN.

199. Undergraduate Open Seminar. 0 to 9 hours.

Persian

(See Asian Studies)

Petroleum Engineering

(See Metallurgy and Mining Engineering)

PHILOSOPHY

Chairman of Department: Professor J. D. WALLACE

Department Office: 105 Gregory Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours from any courses offered by the department, to include Philosophy 102, 303, 306, 321, and one additional 300 course in philosophy.

Minors: Twenty course hours in one or two of the subjects recognized as majors by the College of Liberal Arts and Sciences, or from any approved Liberal Arts and Sciences interdepartmental curriculum, or from education or library science or linguistics. Rhetoric 105, 108, first-year modern foreign language courses, and courses in applied music are excluded. If two departments or curricula are chosen, at least eight hours must be taken in each.

Departmental Honors Program and Distinction: Qualified philosophy majors may become candidates for graduation with distinction in philosophy by undertaking a special course of study. This normally will include writing a thesis and taking the senior seminar. A full description of this program and the conditions of eligibility can be obtained in the department office, 105 Gregory Hall. Eligible students who wish to enroll in this program should register with the Department of Philosophy at the beginning of the first semester of their senior year.

Note: Freshman James Scholars are automatically permitted to take any 100-level philosophy course.

101. **Introduction to Philosophy.** Prerequisite: Sophomore standing or consent of chairman of department. 3 hours.
102. **Logic.** Reasoning, detection of fallacies, evidence. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours.
103. **Ethics and Social Policy.** An examination of the moral aspects of social problems and a survey of ethical principles formulated to validate social policy. Credit is not given for both Philosophy 103 and 105. Prerequisite: Sophomore standing or consent of chairman of department. 4 hours.
104. **Philosophy of Democracy.** An examination of the philosophical bases of democracy and some of its opponents. Prerequisite: Sophomore standing or consent of chairman of department. 4 hours.
105. **Moral Ideas and Practice.** Credit is not given for both Philosophy 105 and 103. Prerequisite: Sophomore standing or consent of chairman of department. 2 hours.
110. **World Religions.** Same as Religious Studies 110. A survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours.
195. **Freshman Seminar.** Investigation of selected fundamental topics of philosophical inquiry, as announced each semester. Prerequisite: Freshman James Scholar. 3 hours.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
210. **Ethics.** Problems in ethical theory; the nature of right and wrong, justice, conscience, moral feelings, etc. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Religious Studies 230. A critical study of theories about the nature of religion. 3 hours.
270. **Philosophy of Science.** Investigation of the nature of scientific knowledge by examining archetypal examples from physical science (e.g., Ptolemaic and Copernican astronomy); nature of scientific truth, validation of theories, nature of scientific theories, evolution of theories, experimental procedure, role of presuppositions, scientific revolutions, etc. 3 hours.
291. **Reading Course.** Readings in selected philosophical topics. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to juniors and seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. Course may be repeated to a total of 4 hours credit.
292. **Thesis.** Special training in philosophical investigation. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. Course may be repeated to a total of 4 hours credit.
295. **Senior Seminar.** Seminar on selected philosophical topics. Prerequisite: Open to senior philosophy majors with a general grade-point average of 4.0 only with consent of instructor. 3 hours. Course may be repeated to a total of 6 hours credit.

Note: Sophomore James Scholars who have had no philosophy courses are permitted to take Philosophy 303, 306, 307, and 308.

303. **History of Ancient Philosophy.** A survey primarily of the Greeks, dealing with such topics as knowledge, metaphysics, ethics, theory of nature, and mysticism. 4 hours or 1 unit.
304. **History of Medieval Philosophy.** Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. Prerequisite: Philosophy 101 or 303. 3 hours, or 3/4 or 1 unit.
306. **History of Modern Philosophy.** 4 hours or 1 unit.
307. **History of Modern Philosophy.** Bacon, Hobbes, Locke, Berkeley, and Hume. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or 1/2 unit. Offered in the summer session only.
308. **History of Modern Philosophy.** Descartes, Spinoza, Leibnitz, and Kant. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or 1/2 unit. Offered in the summer session only.
309. **The Philosophy of Plato.** Prerequisite: Philosophy 101 or 303. 3 hours, or 3/4 or 1 unit.
310. **The Philosophy of Aristotle.** An intensive study of major works in Aristotle or of some aspect of his philosophy. Prerequisite: Philosophy 101 or 303. 3 hours or 1 unit.
311. **Philosophic Ideas of the Nineteenth Century.** Prerequisite: One course in philosophy (preferably Philosophy 101 or 306). 3 hours, or 3/4 or 1 unit.
312. **The Philosophy of Kant.** An intensive study of the major works of Kant, and in particular, of the *Critique of Pure Reason*. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
313. **American Philosophy.** The history of philosophy in America from colonial times to the present. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
315. **European Philosophy Since 1900.** An introduction to the major recent philosophical movements in Europe, such as phenomenology, existentialism, philosophical anthropology, and neo-Marxism. 3 hours or 1 unit.
316. **Anglo-American Philosophy Since 1900.** An introduction to the major philosophical developments in England and America in the present century, focusing on such writers

as G. E. Moore, Bertrand Russell, A. J. Ayer, Ludwig Wittgenstein, and W. V. Quine. Prerequisite: One course in philosophy. 3 hours or 1 unit.

321. **Ethics and Value Theory.** Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
322. **Recent Developments in Ethics.** Ethical theories of the last fifty years; intuitionism, naturalism, pragmatism, emotivism, existentialism, and analytic ethics. Prerequisite: Philosophy 103, 105, or 321. 3 hours, or 3/4 or 1 unit.
323. **Philosophy of Art.** 3 hours, or 3/4 or 1 unit.
324. **Philosophy of Religion.** Same as Religious Studies 362. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their modern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
325. **Philosophy of Mind.** Philosophical problems arising in connection with mental phenomena; the relation of mind and body; free will and determinism; our knowledge of other minds; the self and personal identity. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
326. **Metaphysics.** Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
327. **Philosophy of Science: Advanced Survey.** A comprehensive survey of the literature on the main problems in the philosophy of science, with an emphasis on the physical sciences. Topics include nature of theories, laws and counterfactuals, inductive logic and confirmation theory, models, experimental methodology, explanation, development of theories, concept formation. Prerequisite: Philosophy 270, junior standing, or consent of instructor. 3 hours or 1 unit.
328. **Philosophy of Science.** A study of some philosophical problems that have developed from modern sciences. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
329. **The Philosophy of Social Science.** Same as Anthropology 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
330. **Theory of Knowledge.** The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism, other selected contemporary topics. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
331. **Analytic Philosophy.** Advanced treatment of problems of knowledge and method, and introduction to contemporary techniques of philosophical analysis; meaning and verification; inductive and deductive method; perceptual knowledge; certainty; other selected topics. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
332. **Perception and Knowledge.** A systematic study of basic problems in the philosophy of perception; perceiving as a mental state; the objects of perception; sensing, sensation, and sensedata; perception and the external world; perception as the basis for empirical knowledge. Traditional empiricist philosophies of perception are examined and contemporary criticisms and defenses are assessed. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
333. **Symbolic Logic.** A study of the elementary principles of symbolic analysis as applied to logical problems. 3 hours, or 3/4 or 1 unit.
334. **Symbolic Logic.** A general study of the more refined methods of symbolic analysis as applied to logical problems. Particular attention is devoted to proof procedures as they relate to the question of consistency and completeness. Prerequisite: Philosophy 333. 3 hours, or 3/4 or 1 unit.
335. **Social Philosophy.** Selected topics from the nature of social organization, nature and convention, utility, justice, equality, liberty, rights, and duties. Prerequisite: Philosophy 103, 105, or 321, or consent of instructor. 3 hours, or 3/4 or 1 unit.
336. **Philosophy of Law and of the State.** Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.

337. **Semantics.** An investigation of semantical concepts such as denoting and truth; a study of the functions of language; definition, meaning and verification, semantical paradoxes. Prerequisite: A course in logic. 3 hours, or 3/4 or 1 unit.
338. **Philosophies of Language.** Same as Linguistics 338. A study of the development of philosophical problems about language and the treatment of them from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
339. **Philosophy of Mathematics.** Introduction to some of the main philosophical problems and contemporary viewpoints concerning mathematical concepts, mathematical methods, and the nature of mathematical truths; the concept of infinity; conventionalism and formalism; the distinction between analytic and synthetic truths; necessity; mathematics and the problem of universals; other related topics. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
340. **The Philosophy of Alfred North Whitehead.** An examination of the mature thought of A. N. Whitehead, primarily as contained in *Process and Reality and Adventures of Ideas*, taking into account both the cosmological scheme and the application of his technical philosophy to social philosophy, to ethics, and to philosophy of religion. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
341. **Existential Philosophy.** A study of a selection of the major writings of the more important existential philosophers, e.g., Heidegger, Jaspers, Sartre. Prerequisite: One course in philosophy (preferably Philosophy 311), or consent of instructor. 3 hours, or 3/4 or 1 unit.
343. **Phenomenology.** A study of the development of phenomenology from Husserl to the present. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
345. **Marxist Philosophy.** An examination of the philosophical writings of a number of Marxist writers, from Marx himself to such Neo-Marxists as Schaff, Petrovic, Sartre, and Marcuse. 3 hours, or 3/4 or 1 unit.
353. **Metamathematics, I.** Formal mathematical systems and their semantics: sentential first-order predicate calculus, predicate calculus with identity; formal semantics and model theory of these systems, consistency and completeness theorems; Gödel Completeness Theorem, Lowenheim-Skolem Theorem, Compactness Theorem. Intended primarily for philosophy majors. Prerequisite: Philosophy 102, graduate standing, or consent of instructor. 3 hours or 1 unit.
354. **Metamathematics, II.** Continuation of Philosophy 353. Elementary arithmetics; Craig's Theorem and Beth Definability Results; arithematization, recursive enumerability; recursive functions; Church's Thesis; Church's Theorem; Gödel Incompleteness Theorems and their extensions; Tarski's Truth Theorem; alternative approaches to recursive function theory; selected additional topics. Intended primarily for philosophy majors. Prerequisite: Philosophy 353 the previous semester, or consent of instructor. 3 hours or 1 unit.
355. **Inductive Logic.** Philosophical foundations of probability theory—formal development and applications of the frequency, logical, and subjective interpretations to the philosophical problems of induction and confirmation. Prerequisite: Philosophy 333 or 353, Mathematics 410, or consent of instructor. 3 hours or 1 unit.
361. **Comparative Religion.** A comparative study of classical high religions. 3 hours, or 3/4 or 1 unit.
363. **Contemporary Religious Thought.** Same as Religious Studies 369. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "Neoorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
369. **Indian Philosophy.** Same as Religious Studies 368. A survey of Indian philosophy emphasizing readings in the fundamental texts of Indian thought, and developing basic familiarity with the wide range of Indian philosophies and theologies. Prerequisite: Either a previous course in philosophy, or Religious Studies 297, or any of History 387, 393, 397, 398, 399. 3 hours, or 3/4 or 1 unit.

- 401. **Seminar in Ancient Philosophy.** 1 unit. May be repeated for credit.
- 403. **Seminar in Medieval Philosophy.** 1 unit. May be repeated for credit.
- 405. **Seventeenth-Century Continental Thought (Descartes, Spinoza, Leibniz).** A study of the basic philosophical works of the three leading continental thinkers of the century. 1 unit. May be repeated for credit.
- 407. **British Empiricism.** 1 unit. May be repeated for credit.
- 408. **Seminar in Kant.** 1 unit. May be repeated for credit.
- 409. **American Philosophy.** Major American philosophers and movements. Reports and discussions. 1 unit. May be repeated for credit.
- 410. **Seminar in Nineteenth-Century Philosophy.** 1 unit. May be repeated for credit.
- 411. **Seminar in Ethical Theory.** 1 unit. May be repeated for credit.
- 412. **Seminar in Social Philosophy.** A seminar designed to study special problems in social philosophy. Particular attention is given to the contributions of the social sciences to social philosophy. To be offered with varying topics. 1 unit. May be repeated for credit.
- 413. **Logical Theory.** Prerequisite: A course in logic or consent of instructor. May be repeated for credit. 1 unit.
- 415. **Seminar in Metaphysics.** Intensive study of a selected topic of major importance in the field of metaphysics. 1 unit. May be repeated for credit. SHWAYDER.
- 417. **Seminar in the Philosophy of Science.** Various problems arising from specific studies in philosophy pertaining to science and vice versa. To be offered with varying topics. 1 unit. May be repeated for credit.
- 420. **Seminar in Semantics.** Same as Communications 420. Intensive study of important contemporary contributions in the fields of semantics, analytic philosophy, and the philosophy of language. 1 unit. May be repeated for credit.
- 421. **Seminar in Contemporary Problems.** Intensive study of selected problems or topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. 1 unit. May be repeated for credit.
- 423. **Seminar in the Theory of Knowledge.** Selected topics and writings of major importance in the contemporary philosophy of knowledge. 1 unit. May be repeated for credit.
- 425. **Seminar in the Philosophy of Mind.** Selected topics from major writings in the philosophy of mind. 1 unit. May be repeated for credit.
- 430. **Seminar in Aesthetics.** 1 unit. May be repeated for credit.
- 439. **Seminar in the Philosophy of Mathematics.** Detailed examination of important questions arising from philosophical and logical analyses of mathematics. Prerequisite: Consent of instructor. 1 unit. May be repeated for credit.
- 483. **Individual Topics.** Individual study and oral and written reports on topics not covered in other courses. Topics and plan of study must be approved by the candidate's adviser and by the staff member who directs the work. 1/2 or 1 unit (summer session, 1/2 to 2 units).
- 499. **Thesis Research.** 0 to 4 units.

PHYSICAL EDUCATION

- 302. **Problems of Facilities Planning, Construction, and Utilization.** Physical education facilities as related to objectives of physical education; consultant services with planning committees and architects; cost factors in different types of construction; the use of standards as a check on and guide for planning; safety factors; changes in playing surfaces due to research; building and fields maintenance programs. Prerequisite: Physical Education for Men 204 or Physical Education for Women 204, or equivalent, or consent of instructor. 2 hours, or 1/2 or 1 unit.

303. **International Physical Education and Sport.** A study of objectives, methods, personnel, facilities, and evaluation of selected national programs of physical education. Additional consideration is given to sports clubs, indigenous games, and research. Prerequisite: Physical Education for Men 209, Physical Education for Women 209, or consent of instructor. 2 hours, or 1/2 or 1 unit.
304. **Curriculum Development and Trends.** Curriculum planning and development in physical education with emphasis on ecological, biological, psychological, and sociological factors influencing programs in schools and colleges. Prerequisite: Physical Education for Men 204, Physical Education for Women 204, or consent of instructor. 4 hours or 1 unit.
305. **Principles of Ergonomics.** Same as Industrial Engineering and Physiology 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work. Such topics as static and dynamic forces on the human frame, response to environmental stress (heat, vibration, noise), vigilance and fatigue, and man-machine systems are considered. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Industrial Engineering and Physiology 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments. Students become familiar with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
307. **Motor Learning.** Discussion and analysis of scientific principles related to the learning and performance of motor skills; review of related literature and research in motor learning. Prerequisite: Physical Education for Men 206 or Physical Education for Women 206, Physiology 234, Psychology 100, Educational Psychology 100, or equivalents of these courses, or consent of instructor. 4 hours or 1 unit.
349. **Analysis of Small Groups in Play and Sport.** The methodology of small group research and analysis of the small group in play and sport. Culture, social structure, and personality structure in the group; class and student observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or 1/2 or 1 unit.
350. **Theory and Practice of Exercise Therapy.** Theory and practice of therapeutic exercise as it applies to physical rehabilitation of the physically handicapped; physiological and kinesiological principles of physical restoration; physical educator's role as related to ancillary medical forces; problems and principles related to kinesiotherapy, preventive, adapted, and remedial physical education and athletic training. Prerequisite: Anatomy, physiology, physiology of exercise and kinesiology, or consent of instructor. 4 hours, or 1/2 or 1 unit.
394. **Special Topics in Physical Education.** Lecture course on topics of current interest. Specific subjects will be announced in the Time Table. Prerequisite: To be determined for each subject and will be indicated in the Time Table. 2 or 4 hours, or 1/2 or 1 unit.
401. **Administration of Physical Education and Sport.** Analysis of completed research relating to theory and practice of administration in physical education and sport; the development of policy statements and procedures manuals for the various educational levels; experience in the use of the case plan of instruction as a teaching technique for the development of competence and knowledge relating to human relations and administration in this specialized field. Prerequisite: Physical Education for Men or Physical Education for Women 204 or equivalent. 1 unit.
402. **History of Physical Education and Sport.** An analysis of the research literature related to the historical foundations of physical education and sport; discussion of such persistent historical problems as the influence of economics, politics and nationalism, curriculum and methods of instruction, professional preparation, the healthy body, dance, the use of leisure, and amateur and professional sport. Prerequisite: Physical Education for Men or Physical Education for Women 209 or equivalent. 1 unit.

- 406. Philosophy of Physical Education and Sport.** Philosophical analysis of physical education and sport (with some reference to school health and recreation) in the light of the leading philosophical tendencies and possible implications for public and private education; analysis of completed research; includes delineation of one's personal philosophy and the use of philosophical analysis as a research technique. Prerequisite: Philosophy 101; History and Philosophy of Education 305. 1 unit.
- 407. Sport Psychology.** Analysis of psychological factors and principles with special reference to motor performance, learning motor skills, perception and emotion in sports situations; review of literature; independent projects. Prerequisite: Psychology 100; Educational Psychology 211; consent of instructor. 1 unit.
- 408. Principles of Kinesiotherapy.** Analysis of medically approved techniques employed in the treatment of disease and injury by exercise and movement; kinesiological evaluation of principles involved; therapy preparation in teaching techniques; medically prescribed clinical training; literature; research. Prerequisite: Anatomy, physiology, kinesiology, and physiology of exercise, or consent of instructor. 1 unit.
- 416. Experimental Kinesiology.** Mechanical and neuromuscular approach to human movement, analysis, experimental research findings, lecture and laboratory discussions. Prerequisite: Physiology 234 or equivalent and Physical Education for Men or Physical Education for Women 206 or equivalent, or consent of instructor. 1 unit.
- 449. The Sociology of Sport.** Same as Sociology 449. Sociological analysis of sport with emphasis on sociological theory. Sport and games in cross-cultural analysis. Sport's structure and function in modern industrialized society. The system of sport in regard to its role structure, formal organization, and professionalization; its differentiation along social class, age, and sex. Sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
- 451. Scientific Foundations of Physical Fitness.** Scientific basis for physical fitness; analysis of fitness programs and fitness tests; techniques in remedial clinics; literature; research. Includes laboratory session. Prerequisite: Undergraduate anatomy and physiology, tests and measurements. 1 unit.
- 452. Scientific Analysis of Physical Education Activities.** Analysis of selected activities in terms of physiological, anatomical, physical mechanics, and kinesiological features, involving both cinematographical and metabolic methods. Includes laboratory session. Prerequisite: Anatomy, physiology, kinesiology, elementary physics, algebra, and trigonometry, or consent of instructor. 1 unit.
- 453. Anthropometrical and Body Mechanics Research Techniques.** Critical analysis of the techniques of anthropometrical and body mechanics measurements; analysis of selected research studies; laboratory and computational projects in biophysical study. Prerequisite: College algebra and trigonometry; Physical Education 495 or 451. 1 unit.
- 473. Ergonomics Seminar.** Same as Industrial Engineering and Physiology 473. Topics in ergonomics are explored in depth, such as effects of vibration on human performance and biomechanics of the hand. Prerequisite: Physical Education 306. 1/2 unit.
- 490. Seminar.** Lectures, discussions, and critiques on physical education and related subjects by faculty members and visiting professional leaders; presentation and criticism of student theses. 0 credit.
- 493. Independent Study.** Independent research on special projects. Offered summers as special group practicums. 1/2 or 1 unit.
- 494. Special Topics in Physical Education.** Lecture courses in topics of current interest are given under this number. Specific subject matter will be announced in the Time Table. 1/2 or 1 unit.
- 495. Techniques of Research in Health, Physical Education, and Recreation.** Review and appraisal of common research procedures; application of statistical procedures, library methods, evaluation procedures, and experimental methods. 1 unit.
- 499. Thesis Research.** Preparation of theses in physical education. 0 to 4 units.

PHYSICAL EDUCATION FOR MEN

Head of Department: Professor R. G. WRIGHT

Department Office: 120 Huff Gymnasium

Note: Revisions in curricula and changes in organizational structure may alter course content and numerical sequence. Information concerning this may be procured from the departmental office.

100. **Foundation of Physical Activity.** To acquaint the student with a basic knowledge and understanding of physical activity through classroom lectures and discussions, and participation in physical fitness tests and physical conditioning programs; guidance into future lifelong participation in physical activity based on knowledge and attitudes acquired, physical fitness results, and individual interests and needs. 1 hour.
101. **Prescribed Exercise.** Prescribed ameliorative exercises adapted to individual needs, capacities, and interests. Open only to students who are assigned by the Health Service. 1 hour. Course may be repeated to a total of 4 hours credit.
102. **Weight Control.** Knowledge and understanding of factors involved in increasing, decreasing, or retaining body weight; exercises designed to control body weight. Open only to overweight and underweight students who have been approved by the department at registration. 1 hour.
103. **Developmental Activities.** Activities which contribute to the development and maintenance of physical fitness according to social and hygienic standards. 1 hour.
104. **Weight Training.** Skills, knowledge, attitudes, and conditions. 1 hour.
106. **Rugby Football.** Development of basic individual and team skills of rugby and an introduction to rules and offensive and defensive strategies. 1 hour.
107. **Fencing.** Skills, knowledge, attitudes, and conditions. 1 hour.
108. **Wrestling.** Skills, knowledge, attitudes, and conditions. 1 hour.
109. **Personal Defense.** Skills, knowledge, attitudes, and conditions. 1 hour.
110. **Beginning Swimming.** Skills, knowledge, attitudes, and conditions. Open only to non-swimmers. Prerequisite: Nonswimmer; unable to swim twenty-five yards, including a confidence stop for ten seconds. 1 hour.
112. **Intermediate Swimming.** Skills, knowledge, attitudes, and conditions. Prerequisite: Ability to swim twenty-five yards, including a confidence stop for ten seconds, but not the ability to qualify for enrollment in Physical Education for Men 113 or 114. 1 hour.
113. **Aquatic Sports.** Designed for advanced swimmers covering various aquatic activities, including speed swimming, springboard diving, water polo, and skin diving. Prerequisite: Ability to swim one mile non-stop, including one hundred yards of each of the following in good form; crawl, back crawl, and breaststroke; and twenty yards underwater. 1 hour.
114. **Life Saving.** Skills, knowledge, attitudes, and conditions involved in life saving. Prerequisite: Ability to swim one-half mile non-stop, including one hundred yards of each of the following in good form; sidestroke, breaststroke, and front crawl; and twenty yards underwater. 1 hour.
115. **Scuba Diving, I.** Same as Physical Education for Women 113. A basic course in scuba diving open to male and female students. A certification card will be issued upon successful completion of the course. Prerequisite: Physical Education for Men 112 and/or consent of instructor. A permit is required to register and may be obtained from the offices of the directors of the Basic Instruction Program. Each student shall be certified by a medical doctor as physically qualified for scuba diving and must successfully complete a swimming entrance test. 1 hour.
116. **Diving.** Skills, knowledge, attitudes, and conditions. 1 hour.
117. **Water Safety.** American Red Cross instructor training. Prerequisite: Strong swimmer who has a current American Red Cross Senior Life Saving authorization card. 1 hour.

119. **Canoeing.** Skills and knowledge required for handling a canoe with safety. Prerequisite: Ability to jump or dive into deep water while clothed and maintain a survival position for ten minutes. 1 hour.
120. **Basketball.** Open only to those who have not played on an organized team. Skills, knowledge, attitudes, and conditions. 1 hour.
121. **Soccer.** Skills, knowledge, attitudes, and conditions. 1 hour.
122. **Volleyball.** Skills, knowledge, attitudes, and conditions. 1 hour.
123. **Volleyball, II.** Intermediate and advanced skills and techniques. Emphasis on competitive aspects of power volleyball. Prerequisite: Physical Education for Men 122 or consent of instructor. 1 hour.
124. **Tumbling.** Skills, knowledge, attitudes, and conditions involved in tumbling stunts. 1 hour.
125. **Trampoline.** Skills, knowledge, attitudes, and conditions. 1 hour.
126. **Apparatus Stunts.** Skills, knowledge, attitudes, and conditions. 1 hour.
127. **Handball.** Skills, knowledge, attitudes, and conditions. 1 hour.
128. **Squash Racquets.** Same as Physical Education for Women 128. Skills, knowledge, attitudes, and conditions. 1 hour.
129. **Archery.** Skills, knowledge, attitudes, and conditions. 1 hour.
130. **Badminton.** Skills, knowledge, attitudes, and conditions. 1 hour.
131. **Racquetball.** Same as Physical Education for Women 13. Development of basic individual skills, knowledge, and rules, and an introduction to offensive and defensive strategies. 1 hour.
132. **Bowling.** Covers the fundamentals of bowling for beginners. Skills, knowledge, attitudes, and conditions. 1 hour.
133. **Bowling, II.** Advanced techniques of bowling, including the hook delivery and systems of spare bowling, correction of improper techniques. Prerequisite: Physical Education for Men 132 or consent of instructor. 1 hour.
134. **Golf, I.** The development of skills, knowledge, attitudes, and conditions essential to playing golf. 1 hour.
135. **Golf, II.** Same as Physical Education for Women 135. Development of individual skills beyond the beginning level, including use of the woods, analysis of playing situations, fairway shots, approach shots, sand trap shots, and putting. Prerequisite: Physical Education for Men 134; consent of instructor. 1 hour.
136. **Track and Field.** Skills, knowledge, attitudes, and conditions. 1 hour.
137. **Tennis, I.** Skills, knowledge, attitudes, and conditions. 1 hour.
138. **Tennis, II.** Development of individual skills beyond the beginning level, including volley, lob, smash, and American serve, advanced court and playing strategies, officiating techniques, and tournament structure. Prerequisite: Physical Education for Men 137 and/or consent of instructor. 1 hour.
139. **Techniques at Angling.** Same as Physical Education for Women 139. A beginner's course in bait, fly, and spin casting. Skills, knowledge, dispositions, and conditions. 1 hour.
141. **Ice Hockey.** Development of basic individual skills, knowledge, rules, and introduction to offensive and defensive strategies. Prerequisite: Physical Education for Men 146 and/or consent of instructor. 1 hour.
142. **Ballroom Dance.** A beginning course. 1 hour.
143. **Ballroom Dance, II.** Same as Physical Education for Women 143. Continuation of Physical Education for Men 142. Advanced steps and styling of the foxtrot, swing, waltz, cha cha, and rumba, and introduction to the basic steps of the samba, bolero, tango, quickstep, paso doble, and mombo. Prerequisite: Physical Education for Men 142 or consent of instructor. 1 hour.
144. **American Square Dancing.** 1 hour.

145. **International Folk Dance.** Same as Physical Education for Women 145. An introductory course involving exploration of cultural characteristics of various foreign countries as seen through the folk dance idiom, a study of basic skills common to all folk dances, and development of an appreciation of various styles of folk dance. 1 hour.
146. **Figure Skating, I.** Same as Physical Education for Women 145. Instruction in skills and knowledge that are basic to figure skating. 1 hour.
147. **Figure Skating, II.** Same as Physical Education for Women 147. Instruction in skills and knowledge necessary to pass the United States Figure Skating Association preliminary tests in figures and dance, and instruction in other variations of figure skating skills. Prerequisite: Physical Education for Men 146 or consent of instructor.
148. **Figure Skating, III.** Same as Physical Education for Women 148. Instruction in skills and knowledge necessary to pass the United States Figure Skating Association first eight tests in figures and dance, and instruction in other advanced variations of figure skating skills. Prerequisite: Physical Education for Men 147 or consent of instructor.
149. **Basic Movement.** Foundation course. Free movement activities, knowledge, and appreciation. For music majors only. 1 hour.
150. **Introduction to Physical Education.** The student is introduced to five foundational areas—the historical, philosophical, physiological, psychological, and sociological—of physical education. A sixth unit in the course is designed to orient the student to the scope of the profession, including professional opportunities in the allied areas such as health and safety education, and recreation. 2 hours.
151. **Beginning Basketball.** This introductory course focuses on the skill and knowledge of basketball and stresses the techniques and understandings which are necessary in teaching and coaching basketball. 2 hours.
152. **Beginning Football.** This introductory course focuses on the skill and knowledge of football and stresses the techniques and understandings which are necessary in teaching and coaching football. 2 hours.
153. **Fitness Programs.** This course includes subject matter related to the “why” and “how” of physical activity. Lectures provide an introduction to the physiology of exercise. Practical work includes physical fitness tests, calisthenics, and leadership techniques in a physical education class. 2 hours.
154. **Swimming.** This introductory course focuses on the skill and knowledge of swimming and stresses the techniques and understandings which are necessary in teaching and coaching swimming. 2 hours.
155. **Gymnastics.** This introductory course focuses on the skill and knowledge of gymnastics and stresses the techniques and understandings which are necessary in teaching and coaching gymnastics. 1 hour.
156. **Wrestling.** This introductory course focuses on the skill and knowledge of wrestling and stresses the techniques and understandings which are necessary in teaching and coaching wrestling. 1 hour.
157. **Track and Field.** This introductory course focuses on the skill and knowledge of track and field and stresses the techniques and understandings which are necessary in teaching and coaching track and field. 1 hour.
158. **Baseball.** This introductory course focuses on the skill and knowledge of baseball and stresses the techniques and understandings which are necessary in teaching and coaching baseball. 1 hour.
161. **Special Sports (Soccer and Volleyball).** Soccer and volleyball introductory skills, rules, strategy, teaching, and coaching techniques. 1 hour.
162. **Special Sports (Tennis and Squash).** A course that focuses on the skills and knowledge of racquet games. Instruction in the skills of tennis and squash is provided. Eight weeks are devoted to squash and eight to tennis. 1 hour.
163. **Special Sports (Lacrosse and Handball).** Skills, rules, strategy, and teaching and coaching techniques of lacrosse and handball. 1 hour.

164. **Special Sports (Golf and Fencing).** Same as Physical Education for Women 164. Skills, rules, strategy, and teaching and coaching techniques of golf and foil fencing. 1 hour.
165. **Archery-Badminton.** Includes basic skills of archery and badminton as well as knowledge related to history, nomenclature, rules, and etiquette in these sports. It also includes methods of teaching archery and badminton. 1 hour.
166. **Elementary School Games.** Games for classroom, playground, and gymnasium; programs, lesson planning, and source materials. 3 hours.
170. **Outdoor Recreational Sports.** Same as Physical Education for Women 170. Soccer, volleyball, speedball, archery, tennis, golf, etc. 2 hours.
171. **Indoor Recreational Sports.** Same as Physical Education for Women 171. Badminton, handball, paddle tennis, squash racquets, table tennis, deck tennis, etc. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
204. **Administration of Physical Education.** The scope of this course is concerned with the organization and administration of a total physical education program, including administrative philosophy, the physical education program, physical education staff, facilities and equipment, the budgetary process, legal liability, discipline, and public relations. 3 hours.
205. **Tests and Measurements in Health, Physical Education, and Recreation.** Body type, organic, body mechanics, motor fitness, physical ability, and knowledge tests. 3 hours.
206. **Kinesiology.** Same as Physical Education for Women 206. Mechanics and muscular action of balance and movement of the human body. Prerequisite: Physiology 103 and 234. 3 hours.
207. **Prevention and Care of Athletic Injuries.** Diagnostic procedures, massage, taping, bandaging, hydrotherapy, electrotherapy, handling emergency conditions, training quarters, facilities, and hygiene. Prerequisite: Physiology 103 and 234. 3 hours.
208. **Theory of Prescribing Exercise.** Prescription and conduct of recreational and exercise programs for selected physical handicaps. Prerequisite: Physiology 103 and 234. 3 hours.
209. **History of Sport.** Same as Physical Education for Women 209. Deals principally with the social cultural, and economic aspects of the sport movement in the Western world. Secondary emphasis on methods of historical research. Prerequisite: Senior standing or consent of instructor. 3 hours.
210. **Inspection Trip.** Observations of physical education, health, and safety programs in public and private institutions. Three-day bus trip to a metropolitan center; estimated cost, \$25.00. 0 credit.
213. **Advanced Football.** Offensive and defensive strategy; training drills. Prerequisite: Physical Education for Men 152. 1 hour.
214. **Advanced Basketball.** Offensive and defensive strategy; training drills. Prerequisite: Physical Education for Men 151. 1 hour.
215. **Advanced Gymnastics.** This advanced course of gymnastics involves the review of basic skills and study of advanced skills, and leads to qualification as an instructor of gymnastics at the elementary, secondary, and college levels. Methods of teaching, safety devices and practices, and practical learning of progressions for the several gymnastics events are included. Prerequisite: Physical Education for Men 155 or consent of instructor. 2 hours.
216. **Advanced Wrestling.** Advanced wrestling is designed to review the basic skills and introduce more advanced wrestling techniques and strategies, thereby preparing better qualified wrestling instructors and coaches for the various educational levels. Prerequisite: Physical Education for Men 156 or consent of instructor. 2 hours.
217. **Theory of Coaching.** Basketball, football, and baseball schedule making; team management; scouting, and officiating. Prerequisite: Physical Education for Men 213 and 214, or consent of instructor. 2 hours.
220. **Physical Education for the Classroom Teacher.** Methods and materials in physical

education applicable to all grade levels. For non-physical education students. Prerequisite: Junior standing. 2 hours.

225. **Supervised Experience in Physical Education.** Supervised experience in pre-student teaching in selected basic instruction courses in physical education. Prerequisite: Junior standing. 1 or 2 hours. Must be repeated for a total of 3 hours. Two hours credit is earned when course is first completed, and one hour is earned when course is repeated.
235. **Square and Ballroom Dance.** Same as Physical Education for Women 235. Designed for men and women students majoring in physical education, recreation, and dance. Methods of teaching and directing ballroom, folk, and American square dances in school and community groups with an emphasis on organization and leadership. 2 hours.
240. **Physiology of Human Exercise.** Same as Physical Education for Women 240. A lecture and laboratory course to study basic physiological functions of the body. Participants are expected to observe, describe, and record the immediate and long-range effects of exercise upon the human body, thereby learning to administer techniques and procedures of training and become acquainted with research relating to exercise. Prerequisite: Physiology 103 and 234. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5, consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours credit.
260. **Honors Seminar.** Same as Health Education, Physical Education for Women, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.
271. **Administration of High School Sport Programs.** Organization of sports programs, team sports, intramural programs, and recreational sports programs. 3 hours.
272. **Organization of Aquatic Programs.** Same as Physical Education for Women and Recreation 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.

PHYSICAL EDUCATION FOR WOMEN

Acting Head of Department: Professor R. G. WRIGHT

Department Office: 117 Freer Gymnasium

Note: Revisions in curricula and changes in organizational structure may alter course content and numerical sequence. Information concerning this may be procured from the departmental office.

100. **Basic Movement.** Foundation course. Free movement activities, knowledge and understanding of factors relative to the structure and function of the human body in various fundamental movement skills. Recommended to be taken in the freshman year. 1 hour.
101. **Prescribed Exercise.** Individualized instruction. Recommendation from Health Service or Department of Physical Education for Women is necessary for registration in this course. 1 hour.
103. **Conditioning and Figure Control.** Activities which contribute to the development and/or maintenance of physical fitness and a well-proportioned figure. Knowledge and understanding relative to body types, specific development, corrective exercises, release of tension. 1 hour.

104. **Tumbling and Trampolining.** A beginning course in the area of gymnastics, covering skills, knowledge, and attitudes related to tumbling and trampolining. 1 hour.
105. **Modern Gymnastics, I.** Beginning level of rhythmic movements with or without hand apparatus, heavy apparatus (box, Swedish boom horse, ropes, rings, traveling rings, balance beams, uneven bars). 1 hour.
106. **Modern Gymnastics, II.** Rhythmic movement with hoops and clubs; floor exercise, balance beam, uneven bars, and side horse vaulting. Compulsory and optional compositions on balance beam and uneven bars. Prerequisite: Physical Education for Women 105 or consent of instructor. 1 hour.
107. **Fencing.** Designed to develop skills, knowledge, and attitudes essential for effective fencing. Some sections are eight week units. 1 hour.
109. **Personal Defense.** Instruction in skills, knowledge, and attitudes which are directly or indirectly related to defense against an aggressor. Special emphasis is placed upon avoiding attack. 1 hour.
110. **Elementary Swimming.** Skills, knowledge, and attitudes of swimming. Open to non-swimmers and those with no deep water experience. 1 hour.
111. **Sub-Intermediate Swimming.** Skills, knowledge, and attitudes at the sub-intermediate level. Open to those who have one or more skills for deep water swimming but who have had limited prior professional instruction. 1 hour.
112. **Intermediate Swimming.** Skills, knowledge, and attitudes at the intermediate level. Open to swimmers who can execute a minimum of three of the five basic strokes and a standing dive with consistency and effectiveness.
113. **Scuba Diving, I.** A basic course in scuba diving open to male and female students. A certification card will be issued upon successful completion of the course. Prerequisite: Physical Education for Women 112 and/or consent of instructor. A permit is required to register and may be obtained from the offices of the directors of the Basic Instruction Program. Each student shall be certified by a medical doctor as physically qualified for scuba diving and must successfully complete a swimming entrance test. 1 hour.
114. **Life Saving.** American Red Cross skills, knowledge, attitudes, and conditions for prevention of aquatic mishaps and for life saving. Prerequisite: Physical Education for Women 112 or consent of instructor; ability to swim 18 lengths of front crawl, breast stroke, and side stroke. 1 hour.
115. **Synchronized Swimming.** Skills, knowledge, and attitudes for creating aquatic compositions. Prerequisite: Physical Education for Women 112 or consent of instructor. 1 hour.
116. **Diving.** Skills, knowledge, and attitudes for basic and intermediate dives. Prerequisite: Physical Education for Women 112 or consent of instructor. 1 hour.
117. **Water Safety.** American Red Cross instructor training for the teaching of swimming and life saving. Prerequisite: Physical Education for Women 112 or consent of instructor; a current American Red Cross Senior Life Saving authorization card. 1 hour.
118. **Competitive Swimming.** Skills, knowledge, and attitudes for developing strokes, starts, and turns. Conditioning and training for a competitive season as well as meet organization and participation. Prerequisite: Physical Education for Women 112 or consent of instructor. 1 hour.
120. **Basketball.** Designed to develop skills and knowledge essential for participation in five-player basketball. Rules, strategies, officiating, and tournament play are emphasized. 1 hour.
122. **Volleyball.** Designed to develop skills and knowledge essential for participation in power volleyball. Rules, strategies, officiating, and tournament play are emphasized. Some sections meet with Physical Education for Men 122. 1 hour.
125. **Field Hockey.** Designed to develop skills and knowledges essential for active participation in field hockey. Rules, strategies, officiating and tournament play are emphasized. Eight week unit. 1 hour.
126. **Lacrosse.** Designed to develop skills and knowledge essential for active participation in

- lacrosse. Rules, strategies, officiating, and tournament play are emphasized. Eight-week unit. 1 hour.
127. **Speedball.** Designed to develop skills and knowledge essential for active participation in speedball. Rules, strategies, officiating, and tournament play are emphasized. Eight-week unit. 1 hour.
128. **Squash Racquets.** Same as Physical Education for Men 128. Skills, knowledges, attitudes, and conditions. 1 hour.
129. **Archery.** Designed to develop skills, knowledge, and attitudes essential for target shooting. Some sections meet with Physical Education for Men 129 and some are eight-week units. 1 hour.
130. **Badminton.** Designed to develop skills, knowledge, and attitudes essential for active participation. 1 hour.
131. **Racquetball.** Same as Physical Education for Men 131. Development of basic individual skills, knowledge, and rules, and an introduction to offensive and defensive strategies. 1 hour.
132. **Bowling.** Designed to develop skills, knowledge, and attitudes essential for effective bowling. Some sections meet with Physical Education for Men 132. Fee, \$7.50. 1 hour.
134. **Golf, I.** Designed to develop skills in the use of irons, and attitudes essential for effective course play. Fee, \$18.00. Eight-week unit. 1 hour.
135. **Golf, II.** Same as Physical Education for Men 135. Development of individual skill beyond the beginning level, including use of the woods, analysis of playing situations, fairway shots, approach shots, sand trap shots, and putting. Prerequisite: Physical Education for Women 134 or consent of instructor. Fee, \$18.00. Eight-week unit. 1 hour.
136. **Track and Field.** Designed to develop skills, knowledge, and attitudes essential for effective participation in the long jumps; hop, step, and jump; high jump; obstacle races; and basketball and softball throws. Eight-week unit. 1 hour.
137. **Tennis, I.** Beginning level, designed to develop skills, knowledge, and attitudes for court play. Eight-week unit. 1 hour.
138. **Advanced Tennis.** Designed to develop advanced skills, knowledge, and attitudes for effective court play. Prerequisite: Physical Education for Women 137 or consent of instructor. Eight-week unit. 1 hour.
139. **Bait, Fly, and Spin Casting.** Same as Physical Education for Men 139. A beginners' course in bait, fly, and spin casting. Skills, knowledge, dispositions, and conditions. 1 hour.
140. **Modern Dance, I.** An introductory course in the fundamentals of free and creative dance. 1 hour.
142. **Ballroom Dance, I.** Meets with Physical Education for Men 142. Beginning course in ballroom dancing. 1 hour.
143. **Ballroom Dance, II.** Continuation of Physical Education for Women 142. Advanced steps and styling of the foxtrot, swing, waltz, cha cha, and rumba, and introduction to the basic steps of the samba, bolero, tango, quickstep, paso doble, and mombo. Prerequisite: Physical Education for Women 142 or consent of instructor. 1 hour.
144. **American Square Dance.** Meets with Physical Education for Men 144. Practice and leadership in conducting and calling dances. 1 hour.
145. **International Folk Dance.** Same as Physical Education for Men 145. An introductory course involving exploration of cultural characteristics of various foreign countries as seen through the folk dance idiom, a study of basic skills common to all folk dances, and development of an appreciation of various styles of folk dance. 1 hour.
146. **Figure Skating, I.** Same as Physical Education for Men. Instruction in skills, and knowledge that are basic to figure skating. Eight-week unit. 1 hour.
147. **Figure Skating, II.** Same as Physical Education for Men 147. Instruction in skills and knowledge necessary to pass the United States Figure Skating Associations preliminary tests in figures and dance, and instruction in other variations of figure skating skills. Prerequisite: Physical Education for Women 146 or consent of instructor.

148. **Figure Skating, III.** Same as Physical Education for Men 148. Instruction in skills and knowledge necessary to pass the United States Figure Skating Association first eight tests in figures and dance, and instruction in other advanced variations of figure skating skills. Prerequisite: Physical Education for Women 147 or consent of instructor.
150. **Professional Orientation.** Introduction to theories and concepts derived from psychology, sociology, history, philosophy, and biology which have relevance to the teaching and learning of motor skills; introduction to physical education as a profession. 2 hours.
151. **Basic Movement and Body Mechanics.** Experiences, skills, and knowledge relative to structure and function of the human body in selected physical education and dance activities. 1 hour.
152. **Hockey and Volleyball.** Development of skills, knowledge, and game strategies with secondary emphasis on relationship to basic movement patterns and methodology. Each sport meets for one-half semester. 1 hour.
153. **Basketball, Track, and Field.** Development and understanding of skills, strategy, and rules of basketball; application of physiological and mechanical principles in the development of skills. Basic skills of running, jumping, and throwing as performed in track and field; emphasis on understanding knowledge, and techniques essential to teaching track and field. Each sport meets for one-half semester. 1 hour.
154. **Softball, Gymnastics, and Apparatus, I.** Development of softball skills, knowledge, and game strategies; coaching and officiating techniques; secondary emphasis on relationship to basic movement and methodology. Skills and knowledge relevant to rhythmic gymnastics, balance beam, uneven parallel bars, horse, buck. Each activity meets for one-half semester. 1 hour.
155. **Gymnastics and Apparatus, II, and Tennis.** Development of tennis skills, knowledge, and game strategies with secondary emphasis on relationship to basic movement and methodology. Advanced activities on balance beam, horse, buck, parallel bars, boom, rings. Routines in rhythmic gymnastics with ropes, hoops, indian clubs, and large groups. Each activity meets for one-half semester. Prerequisite: Physical Education for Women 154 or consent of instructor. 1 hour.
156. **Stunts, Tumbling, and Trampoline.** Tumbling progressions, trampoline stunts, free exercise routines, and individual and partner stunts for children. Methods of teaching, class organization, spotting, and safety. Students are required to create and present a routine. Prerequisite: Credit or registration in Physical Education for Women 151. 1 hour.
157. **Modern Dance.** Fundamentals of modern dance designed for the teacher of physical education. Development of basic skills in dance form, elements of dance movement; creative movement patterns; improvisation; and basic elements of composition for the performer and the teacher. 1 hour.
164. **Special Sports (Golf and Fencing).** Same as Physical Education for Men 164. Skills, rules, strategy, and teaching and coaching techniques of golf and foil fencing. 1 hour.
165. **Teaching of Swimming.** Analysis of basic water adjustment skills and swimming strokes; related teaching methods; program and organizational concerns. Prerequisite: Sophomore standing; Physical Education for Women 112 and 151. 2 hours.
166. **Elementary School Games.** Weekly laboratory experience with children, teaching games and guiding play. Emphasis on child behavior and ability, lesson planning, teacher created learning situations, and characteristics of age groups. Prerequisite: Sophomore standing; credit or registration in Psychology 216 or 217 or Educational Psychology 236. 3 hours.
167. **Teaching of Gymnastics and Dance.** Techniques and progressions of modern gymnastics and contemporary dance. Experience in teaching groups; lesson plans; unit progressions; adapting dance, light and heavy apparatus to children and girls. Prerequisite: Junior standing; Physical Education for Women 154, 155, 157, and 166. 2 hours.
180. **Basketball Officiating.** Presents the knowledge and game concepts of basketball officiating. Instruction, game play, and practical officiating experience essential to becoming a trained and rated DGWS-OSA basketball official. 1 hour.

181. **Volleyball Officiating.** Presents the knowledge and concepts of volleyball officiating. Instruction, game play, and practical officiating experience essential to becoming a trained and rated DGWS-OSA volleyball official. Prerequisite: Physical Education for Women 124 or 152, or consent of instructor. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
204. **Organization of Physical Education.** Organization and administration of the high school program in physical education for girls. Study of problems involved in equipment, facilities, curriculum, class routines, and record keeping. Prerequisite: Registration in Educational Practice 238, 242, and 250. 3 hours.
205. **Tests and Measurements in Health, Physical Education, and Recreation.** Survey and analysis of measurements of motor ability and fitness, skills, and knowledge; interpretation of the results of tests; grading procedures. Prerequisite: Junior standing; registration in Physical Education for Women 213 and 215. 3 hours.
206. **Kinesiology.** Same as Physical Education for Men 206. Mechanics and muscular action of balance and movement of the human body. Prerequisite: Physiology 103 and 234. 3 hours.
208. **Theory of Prescribing Exercise.** Deals primarily with understanding, evaluating, and developing programs for postural deviations and deviations of the feet; injuries to the muscles, bones, and joints; activities for exceptional children. Prerequisite: Physical Education for Women 206. 3 hours.
209. **History of Sport.** Same as Physical Education for Men 209. Deals principally with social, cultural, and economic aspects of the sport movement in the Western world. Secondary emphasis on methods of historical research. Prerequisite: Senior standing or consent of instructor. 3 hours.
210. **Observation Trips.** Observation of physical education programs in public institutions and attendance at an annual convention; approximate cost \$30.00. Prerequisite: Junior standing. 0 credit.
213. **Teaching of Team Sports.** Lectures, reading, and laboratory work and discussion related to motor learning and methods of teaching. Laboratory work in the teaching of field hockey, volleyball, basketball, and softball. Prerequisite: Junior standing; Physical Education for Women, 151, 152, 153, 154, 166, and Physical Education for Women 165 or 214, or consent of instructor; registration in Physical Education for Women 205 and 215. 4 hours.
214. **Teaching of Individual Sports.** Lectures discussion, reading, and laboratory work related to the teaching of individual sports—tennis, golf, archery, badminton, and track and field. Prerequisite: Junior standing; Physical Education for Women 151, 153, 155, and 166, or consent of instructor. 2 hours.
215. **Supervised Experience and Teaching, II.** Laboratory assignments for experience in teaching, officiating, and observation of physical education in the University basic instruction program. Prerequisite: Junior standing; Physical Education for Women 216; registration in Physical Education for Women 205 and 213. 0 credit.
216. **Supervised Experience and Teaching, I.** Laboratory assignments for experiences in observing and teaching physical education in the University basic instruction program. Prerequisite: Junior standing; Physical Education for Women 166; completion of one elected individual sport. 0 credit.
220. **Physical Education for the Classroom Teacher.** Curriculum, methods, and organization of physical education in the elementary school. For non-physical education majors. Prerequisite: Junior standing. 2 hours.
222. **Physical Education in the Elementary School.** Curriculum planning, methods, organization, and evaluation of physical education in the elementary school. Prerequisite: Physical Education for Women 154 and 166; Dance 235; forty-eight or more hours of approved laboratory work with children or consent of instructor. 2 hours.
230. **Secondary School Program in Physical Education for Girls.** Curriculum and program planning, teaching of selected physical activities, source materials. Designed for teachers

qualifying for state certification as minors in physical education. Prerequisite: Consent of instructor. 4 hours. Offered in the summer session only.

231. **Individual Sport Program for Secondary School Girls.** Planning and conduct of program, knowledge and practice of sports, methods of teaching, equipment, source materials. Archery, badminton, golf, tennis, track and field. Designed for teachers qualifying for state certification as minors in physical education. Prerequisite: Physical Education for Women 230 or consent of instructor. 4 hours. Offered in the summer session only.
235. **Square and Ballroom Dance.** Same as Physical Education for Men 235. Designed for men and women students majoring in physical education, recreation, and dance. Methods of teaching and directing ballroom, folk, and American square dances in school and community groups with an emphasis on organization and leadership. 2 hours.
236. **Folk Dance.** Designed for men and women students majoring in physical education, recreation, and dance. Selected ethnic folk dances with an emphasis on the teaching and directing of school and community groups. 1 hour.
240. **Physiology of Human Exercise.** Same as Physical Education for Men 240. A lecture and laboratory course to study basic physiological functions of the body. Participants are expected to observe, describe, and record the immediate and long-range effects of exercise upon the human body, thereby learning to administer techniques and procedures of training and become acquainted with research relating to exercise. Prerequisite: Physiology 103 and 234. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours.
260. **Honors Seminar.** Same as Health Education, Physical Education for Men, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours.
272. **Organization of Aquatic Programs.** Same as Physical Education for Men and Recreation 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.

PHYSICS

Head of Department: Professor R. O. SIMMONS

Department Office: 211 Physics Building

REQUIREMENTS FOR L.A.S. STUDENTS IN PHYSICS CURRICULUM

For the L.A.S. curriculum in physics, see the Undergraduate Study catalog.

REQUIREMENTS FOR ENGINEERING STUDENTS IN ENGINEERING PHYSICS CURRICULUM

For the curriculum in engineering physics, see the Undergraduate Study catalog.

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in physics including Physics 321, 341, and 342, and excluding 100-level courses.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: astronomy, chemistry, education, geology, mathematics, zoology, or any one branch of engineering.

Physics 101 and 102 are recommended to premedical, predental, and architecture students not specializing in physics, mathematics, chemistry, or engineering.

The general physics prerequisite for certain courses may be satisfied by either Physics 101 and 102, or Physics 106, 107, and 108. The calculus prerequisite may be satisfied either by Mathematics 130 and 140, or Mathematics 131 and 141.

101. **General Physics (Mechanics, Heat, and Sound).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Trigonometry. 5 hours.
102. **General Physics (Light, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Physics 101. 5 hours.
106. **General Physics (Mechanics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Mathematics 120; credit or registration in Mathematics 130 or 131. 4 hours.
107. **General Physics (Heat, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 106; credit or registration in Mathematics 140 or 141. 4 hours.
108. **General Physics (Wave Motion, Sound, Light, and Modern Physics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 107; credit or registration in Mathematics 140 or 141. 4 hours.
150. **Physics and the Modern World—A Course for Nonscientists.** A non-mathematical lecture course attempting to bridge the two-culture gap. Taking examples from modern physics—relativity, elementary particles, quantum theory, statistics, etc., this course covers basic philosophical concepts in physics which pervade all human disciplines: model-making, dynamics, ensemble behavior, symmetry. 3 hours.
151. **Special Problems.** Special problems in physics: discussions and independent study. Supplement to Physics 150. Prerequisite: Credit or registration in Physics 150. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
303. **Modern Experimental Physics, I.** Techniques and experiments in the physics of atoms, atomic nuclei, molecules, the solid state, and other areas of modern physical research. Prerequisite: Physics 342; credit or registration in Physics 381 or 386. 5 hours or 1 unit.
304. **Modern Experimental Physics, II.** Continuation of Physics 303. Prerequisite: Physics 303. 5 hours or 1 unit.
321. **Theoretical Mechanics.** Motion of a particle in one, two, and three dimensions, with applications; Kepler's laws and planetary motion; scattering of particles; conservation laws; motion of a rigid body in two dimensions; statics of extended systems. Lectures and problems. Prerequisite: General physics; credit or registration in Mathematics 341, 345, or 349. 4 hours or 1 unit. No graduate credit for graduate physics majors.
322. **Theoretical Mechanics.** Continuation of Physics 321. Moving coordinate frames, fictitious forces; special theory of relativity, conservation laws, particle motion and creation; rigid body motion in three dimensions; gravitation and earth motion; generalized coordinates and Lagrange's equations; constraints, small vibrations. Prerequisite: Physics 321. 4 hours or 1 unit.
341. **Electricity and Magnetism.** This course is fundamental to advanced courses and should be elected as early as possible by those intending to specialize in physics. The fundamental laws are introduced using the vector notation stressing Maxwell's equations in the integral form. Topics covered with applications and problems include direct current circuits, circuit theorems, electric and magnetic fields, Gauss' Law, capacitance and inductance; energy and forces associated with these fields in free space and in matter. Lectures, problems, and laboratory. Prerequisite: General physics, credit or registration in Mathematics 341, 343, or 345, or consent of instructor. 4 hours, or 1/2 or 1 unit. No graduate credit for graduate physics majors.

- 342. Electricity and Magnetism.** Continuation of Physics 341. Effects associated with changing fields and currents. Faraday's Law, displacement current, transient currents, complex variables in circuit analysis, coupled circuits, and circuit theorems. An introduction to the generation and propagation of electromagnetic waves and the wave equations. Prerequisite: Physics 341. 4 hours, or 1/2 or 1 unit. No graduate credit for graduate physics majors.
- 343. Electronic Circuits.** The physics of semiconductor and vacuum tube devices; theory and application of these devices as linear circuit elements in power supplies, amplifiers, communication circuits, and control circuits. Emphasis is on experimental techniques. Lectures, problems, and laboratory. Prerequisite: Physics 341 or consent of instructor. 5 hours or 1 unit.
- 344. Electronic Circuits.** Continuation of Physics 343. Electronic instruments and techniques used in research in physics and in digital computers; theory and experiments emphasizing the use and design of nonlinear circuits, e.g., multivibrators, pulse generators, counters, etc.; theory of switching circuits; special topics. Prerequisite: Physics 343 or equivalent. 5 hours or 1 unit.
- 347. Electromagnetic Theory and Boundary Value Problems.** Beginning with Maxwell's equations, this course treats electrostatic and magnetostatic boundary value problems and multipole expansions with orthogonal polynomials, boundary value problems in quasistatic and radiation fields, simple radiating systems, and scattering of scalar waves. Prerequisite: Mathematics 343 and 345; Physics 342 or Electrical Engineering 229, or consent of instructor. 4 hours or 1 unit.
- 360. Thermodynamics.** Zeroth, first, second, and third laws of thermodynamics; applications to simple physical and chemical systems; thermodynamic inequalities and equilibrium; phase transitions. Lectures and problems. Prerequisite: General physics and calculus; senior standing in physics is advised. 4 hours or 1 unit.
- 362. Kinetic Theory and Statistics.** A lecture and problem course presenting the fundamentals of kinetic theory and an elementary introduction to statistical mechanics. Topics covered include equations of state, the distribution law, viscosity, thermal conduction, diffusion, Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics and applications. Prerequisite: Physics 360 or consent of instructor. 3 hours or 1 unit.
- 365. Introduction to Plasma Physics.** Physical concepts underlying the description of ionized gases; individual particle and continuum models; collision processes in plasmas. Charged particle motion in electromagnetic fields; waves in cold plasmas; elementary treatment of collective plasma behavior; simple plasma instabilities; selected topics of current interest. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 4 hours or 1 unit.
- 366. Aeronomy: Physics of the Upper Atmosphere and Space.** Same as Astronomy 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmosphere; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.
- 371. Light.** Wave optics: description and superposition of waves, coherence, interference, diffraction, polarization, and dispersion; geometrical optics; image formation, optical systems, thick lens theory, image defects; applications to optical instruments. Lectures, problems, and laboratory. Prerequisite: General physics; Mathematics 345 or consent of instructor. 4 hours, or 1/2 to 1 unit.
- 381. Atomic Physics.** Same as Chemistry 396. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules. The topics discussed include evidence for the atomic nature of matter, the properties of free electrons and ions, photons and their interaction with matter, atomic spectra and structure, molecular spectra and structure, and an introduction to the ideas of quantum mechanics. Students may not receive credit for both Physics 381 and 386. Prerequisite: General physics; Mathematics 343 or 345. 4 hours or 1 unit.

382. **Subatomic Physics.** A lecture and problem course surveying subatomic physics, including the nature and properties of nuclei and elementary particles, symmetries, interactions, nuclear models, tools, and techniques of experimental subatomic physics and applications to power generation, astrophysics, chemistry, medicine, and biology. Prerequisite: Physics 383, 385, or 386, or consent of instructor. 4 hours or 1 unit.
383. **Atomic Physics and Quantum Theory.** Introduction to the basic concepts of quantum theory which underlie modern theories of the properties of materials. Topics covered include elements of atomic and nuclear theory, kinetic theory and statistical mechanics, quantum theory and simple applications, atomic spectra and atomic structure, molecular structure and chemical binding. Lectures and problems. Prerequisite: General physics; general chemistry; Mathematics 345 or equivalent. 3 hours, or 3/4 or 1 unit.
385. **Introduction to Quantum Mechanics.** A one-semester treatment of quantum mechanics covering the fundamental postulates of quantum theory, the Schrodinger wave equation as applied to simple bound state and scattering problems, the non-relativistic hydrogen atom, angular momentum, steady-state and time-dependent perturbation theory, and systems of identical particles. Recommended for science students who wish to acquire familiarity with quantum mechanics. Students may not receive credit for both Physics 385 and either of Physics 386 or 387. Prerequisite: Mathematics 343 and 345; general physics through intermediate mechanics and electromagnetic theory. 4 hours or 1 unit.
386. **Atomic Physics and Quantum Mechanics, I.** A study of atomic phenomena integrated with an introduction to quantum theory. Topics discussed include evidence for the atomic nature of matter and the properties of the Schrodinger equation, single particle solutions in one dimension, the hydrogen atom, perturbation theory, external fields, and atomic spectroscopy of outer electrons. Students may not receive credit for both Physics 381 and 386 and for both Physics 385 and 386. Prerequisite: General physics; Mathematics 343 or 345 or consent of instructor. 4 hours or 1 unit.
387. **Atomic Physics and Quantum Mechanics, II.** Topics treated include identical particles, spectral hyperfine structure, magnetic properties of matter, atomic spectroscopy of inner electrons, high energy photon effects, molecular binding and spectra, emission and absorption of light, symmetry principles. Students may not receive credit for both Physics 387 and 385. Prerequisite: Physics 386. 4 hours or 1 unit.
389. **Introduction to Solid State Physics.** Bonding and structure of crystals; energy bands in insulators, semiconductors, and metals; electrical conductivity; optical properties; lattice vibrations; elasticity; point defects; dislocations. Prerequisite: Junior standing in engineering or equivalent. 4 hours or 1 unit.
397. **Individual Study.** Individual study at an advanced level in a subject not covered by course offerings. Prerequisite: Upperclassman; consent of adviser and staff member who supervises the work. 2 to 4 hours, or 1/2 to 1 unit. May be repeated once.
398. **Seminar on Special Topics in Modern Physics.** Lecture course on topics of current interest in physics. For advanced undergraduates or graduates. Subjects and prerequisites to be announced in Time Table. 2 to 4 hours, or 1/2 to 1 unit.
400. **Problems and Methods of Mathematical Physics.** Matrices and tensors; analytic functions of a complex variable; conformal mapping; contour integration; ordinary differential equations: solutions at singular points, contour integral solutions, asymptotic expansions; eigenfunctions and eigenvalues; partial differential equations; Laplace's equation, wave equation, diffusion equation, Green's functions; Legendre, Bessel, confluent hypergeometric, Mathieu, and elliptic functions; elementary difference equations. Prerequisite: Mathematics 342, 345, 347, or 387; Physics 322 and 342, or consent of instructor. 1 unit.
422. **Dynamics and Nonlinear Mechanics.** Hamiltonian mechanics: Lagrange equations, Hamilton's canonical equations, contact transformations, Lagrange and Poincare invariants, Hamilton-Jacobi equation and Huygens' principle; perturbation theory, relaxation oscillations and stability of periodic motion, theory of cosmotron orbits, three-body problems. Prerequisite: Physics 322; Mathematics 345. 1 unit.
424. **Relativity and Cosmology.** Same as Astronomy 424 and Mathematics 460. Elements of

tensor calculus and Riemannian geometry; special relativity: Lorentz transformations; equivalence of mass and energy; general relativity and the gravitational field of the sun; galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit.

430. **Surface Physics.** Same as Metallurgical Engineering 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction and structure; gas-solid collisions; Brownian motion, diffusion and evaporation; electron and ion emission, tunnelling; Van der Waals forces; theory of chemical interactions; kinetics and statistics of absorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
435. **Theory of Semiconductors and Semiconductor Devices.** Same as Electrical Engineering 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; characteristics of p-n junctions, heterojunctions and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
441. **Electrodynamics.** Electrostatics; Laplace's and Poisson's equations; boundary value problems; spherical harmonics; multipole potentials; dielectrics; microscopic and macroscopic fields; electric susceptibility; magnetostatics; magnetic multipoles; magnetic media; conducting media; Maxwell's equations; field energy and momentum; electromagnetic waves; reflection and refraction; dispersion; wave packets; causality; diffraction; wave guides and cavity resonators; simple aspects of magnetohydrodynamics and plasmas. Prerequisite: Physics 342 or equivalent; credit or registration in Physics 400 or consent of instructor. 1 unit.
442. **Electrodynamics.** Special theory of relativity; covariant formulation of electrodynamics; charged particle dynamics; high energy particle accelerators; energy loss by charged particles traversing matter; multiple scattering; Lienard-Wiechert potentials; radiation by charged particles; radiation loss in particle accelerators; Thomson scattering; bremsstrahlung; Weiszacker-Williams method; inner bremsstrahlung; Cerenkov radiation; radiative reaction; natural line breadth; multipole expansion of radiation field; Lagrangian and Hamiltonian formulation of electrodynamics. Prerequisite: Physics 441. 1 unit.
455. **Reactor Physics, I.** Same as Nuclear Engineering 455. An introduction to the physical concepts of reactor analysis; nuclear cross sections, diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; computer applications in reactor analysis. Prerequisite: Nuclear Engineering 347, Mathematics 343 and 345, or consent of instructor. 1 unit.
456. **Reactor Physics, II.** Same as Nuclear Engineering 456. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; digital computer methods. Prerequisite: Physics 455 or consent of instructor. 1 unit.
462. **Statistical Mechanics and Kinetic Theory.** Single-particle distribution functions: classical and quantum mechanical systems, Boltzmann equation, virial theorem, equations of state for gases; formal theory: ensembles, identical particles, thermodynamics of simple systems, distribution functions; non-equilibrium problems; conservation laws and hydrodynamics equations, sound waves, transport coefficients; plasmas, normal Fermi fluid, superfluids, systems with internal degrees of freedom. Prerequisite: Physics 360 and elementary quantum mechanics, or consent of instructor. 1 unit.
463. **Low Temperature Theory and Quantum Liquids.** Normal Fermi liquids: equilibrium properties, transport equation, quasi-particle collisions, degenerate ^3He , Landau theory; formal description of experimental measurements in neutral and charged Fermi liquids; superfluid Bose liquid: He II, rotating buckets, macroscopic description of superfluid flow, two-fluid model, first, second, and quasi-particle sound, vortex lines, microscopic theory; superconductivity: BCS theory, electrodynamics and coherence effects, superconductivity in metals, tunnel effect, flux quantization, microscopic theory of superfluid flow, vortices. Prerequisite: Physics 462 and 481, or consent of instructor. 1 unit.

465. **Plasma Physics.** Basic equations of magnetohydrodynamics; orbit theory; stability of plasma configurations; hydromagnetic waves; plasma oscillations; high-frequency instabilities; spontaneous fluctuation theory; Fokker-Planck equation; transport processes; oscillations in a magnetic field; interaction of electromagnetic waves with plasmas. Prerequisite: Physics 362 and 441, or Electrical Engineering 423, or consent of instructor. 1 unit.
467. **Atomic Collision Processes.** Same as Electrical Engineering 467. Elastic collisions of electrons with neutral atoms; inelastic electron-atom and electron-molecule collisions; collisions between heavy particles; molecule formation; photo-processes and recombination; negative ions; collisions involving the emission of radiation; theory of spectral line-broadening in plasmas; experimental techniques. Prerequisite: Physics 480 or consent of instructor. 1 unit.
470. **Introduction to Nuclear and Particle Physics.** Basic facts of photons, leptons, hadrons, conservation laws, types of interaction, particle production and stability symmetries, nuclear forces, and ground state properties; two-particle systems: electromagnetic interactions, bound states, and resonances; nucleon-nucleon and meson-nucleon interactions; nuclei: properties of low-lying states, models, resonant reactions, and direct processes; particles and weak interactions: multipion resonances, symmetry schemes, beta decay and other leptonic processes, strange particle decays. Prerequisite: Physics 480 or consent of instructor. 1 unit.
471. **Nuclear Physics, I.** Systematics of stable nuclei and the nuclear potential; properties of odd-A nuclei; spherical single particle shell model; residual interactions; collective states and deformed nuclei; summary of theory and experiment for low-lying states; momentum distribution of nucleons; fission. Prerequisite: Physics 470. 1 unit.
472. **Nuclear Physics, II.** Resonance reactions: fast and slow neutron cross sections, neutron and gamma widths, strength functions, giant dipole resonance, compound nucleus, and statistical model; direct reactions: optical model, elastic and inelastic scattering, polarization, angular correlations; spectroscopic factors, intermediate structure, isobaric analogs. Prerequisite: Physics 471. 1 unit.
475. **Particle Physics, I.** Particles: properties and systematics; S-matrix theory; application of symmetry and invariance principles to decays, production processes and polarization; collision processes; mesonic and baryonic resonances; symmetry schemes; particle scattering at very high energies; theory of pion-nucleon scattering, dispersion relations, Mandelstam representation. Prerequisite: Physics 470. 1 unit.
476. **Particle Physics, II.** Electromagnetic interactions of particles, form factor, predictions of unitary symmetry; beta and muon decay and capture, conserved and partially conserved currents, neutrino interactions, weak interaction form factors; leptonic and non-leptonic decays of strange particles; neutral K-meson decays; current topics. Prerequisite: Physics 475. 1 unit.
477. **Seminar in High-Energy Physics.** Under the guidance of faculty, students study and report on topics of current interest in high-energy physics. Prerequisite: Physics 470 or consent of instructor. 1/2 unit.
480. **Quantum Mechanics, I.** A second course in quantum mechanics for students with a good background in wave mechanics and atomic and molecular structure. Operators, state vectors and the formal structure of quantum theory, operator treatments of simple systems; angular momentum, vector addition coefficients; stationary state perturbation theory; introduction to scattering theory for particles without spin, partial wave analysis, Born approximation; with examples taken from atomic, nuclear, and elementary particle physics. Prerequisite: Senior-level atomic physics and quantum mechanics, or consent of instructor. 1 unit.
481. **Quantum Mechanics, II.** Spin and identical particles, simple many-particle systems and elements of second-quantization theory; time-dependent processes, radiative transitions, quantization of the electromagnetic field; scattering of particles with spin, polarization; introduction to the Klein-Gordon and Dirac equations, properties of simple relativistic systems. Prerequisite: Physics 480 or consent of instructor. 1 unit.

- 483. General Field Theory.** A course covering the standard techniques of field theory, as used by experimenters and theorists. Relativistic quantum mechanics of a single particle; Lagrangian field theories, perturbation theory, calculation of lowest-order processes; introduction to Feynman diagrams, higher order processes, examples taken from quantum electrodynamics, solid-state and elementary particle physics and many-body theory. Prerequisite: Physics 481 or consent of instructor. 1 unit.
- 485. Advanced Field Theory.** Renormalization theory dispersion relations, S-matrix theory; current algebra; recent developments. Prerequisite: Physics 483 or consent of instructor. 1 unit.
- 489. Solid State Physics, I.** Introduction to the modern theory of crystalline materials. Topics treated include crystal symmetry, elastic and thermal properties of solids, optical properties, point defects and imperfections in crystals. Prerequisite: Physics 360, 362, 381 and 480, or consent of instructor. 1 unit.
- 490. Solid State Physics, II.** Introduction to band theory of solids, free electron model, electrons in periodic potential, cohesion, transport properties of metals and semiconductors, experimental methods for determining band structure. Prerequisite: Physics 489 or consent of instructor. 1 unit.
- 497. Individual Study.** Individual study in a subject not covered in course offerings may be arranged for credit by registration under this number. 1/2 or 1 unit.
- 498. Seminar on Special Topics in Modern Physics.** Lecture course in topics of current interest. Several subjects are announced in each Time Table. Among them are semiconductor physics, magnetic resonance, surface physics, lattice dynamics, band theory of solids, crystal imperfections, nuclear structure, field theory, elementary particle physics, advanced statistical mechanics, plasma theory, astrophysics, atmospheric physics, group theory, and applications. Prerequisite: Determined for each offering. 1/2 or 1 unit.
- 499. Thesis Research.** 0 to 4 units.

Physiology and Biophysics

(See Life Sciences)

PLANT PATHOLOGY

Head of Department: Professor R. E. FORD

Department Office: 218 Mumford Hall

- 204. Introductory Plant Pathology.** Basic concepts relating to causal agents of representative diseases, symptoms and diagnosis, mode of infection and spread, environment and disease development, and methods of control. Prerequisite: Botany 100 or equivalent. 3 hours. LINN.
- 300. Special Problems:** For students desiring to study specific problems not assigned in other courses. Prerequisite: For undergraduates only, a minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean in advance of registration is required for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 4 hours, or 1/4 to 1 unit.
- 302. Research Methods in Plant Pathology.** Techniques for the isolation, identification, culture of, and inoculation with plant pathogens; methods for the histological study of diseased plants; recording of data. Prerequisite: Plant Pathology 204 or equivalent; senior standing. 3 hours or 3/4 unit. PAXTON.
- 303. Plant Nematology.** Experimental techniques, nematode anatomy, taxonomy, biology,

and host-parasite relations; intensive study of selected groups including foliar, stem, root-knot, and cyst nematodes; interaction with bacteria, fungi, and viruses in plant disease development; control principles. Prerequisite: Plant Pathology 204 or equivalent; an introductory course in zoology or biology. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years. MALEK.

304. **Forest Tree Diseases and Wood Deterioration.** Symptoms, causal agents, and control of the major forest tree diseases; causes and control of wood deterioration. Prerequisite: Junior standing in forestry or other plant science. 3 hours or 3/4 unit. GERDEMANN.
305. **Principles of Plant Disease Control.** A study of the basic concepts of both nonchemical and chemical methods used for the control of plant diseases. Lectures, discussions, and assigned reading. Prerequisite: Plant Pathology 204; Chemistry 102, 132, or 133; or consent of instructor. 3 hours or 3/4 unit. Offered in 1973-1974 in alternate years. SHURTLEFF.
306. **Epiphytology and Diagnosis of Plant Diseases.** Detailed consideration of factors influencing the incidence and severity of diseases caused by fungi, bacteria, viruses, and nematodes; ecological factors as etiological agents, and techniques for determining the intensity of epiphytotics; plant disease identification. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years. SINCLAIR.
307. **International Food Crops.** Same as Horticulture 307. Various international food crops are studied with emphasis on production and problems created by diseases and insects. Tropical and subtropical crops are stressed, but temperate food crops of international importance are included. Ecological factors affecting fundamentals of food crop production and plant protection are emphasized. Prerequisite: Junior standing or consent of instructor. 3 hours or 3/4 unit. Offered in 1972-1973 and in alternate years. SINCLAIR.
377. **Diseases of Field Crops.** Same as Agronomy 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or 3/4 unit. Offered in 1973-1974 and in alternate years. HOOKER.
401. **Diseases of Forest and Shade Trees.** A survey of the history, symptomatology, causes, and control of diseases of trees, with assigned reading and performance of illustrative experiments in the laboratory, greenhouse, and field. Prerequisite: Plant Pathology 204 or consent of instructor. 1/2 or 1 unit. Offered in 1972-1973 and in alternate years. CARTER.
403. **Physiology of Fungi.** Same as Botany 403. The germination, growth, metabolism, and sporulation of fungi; physiology of the fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products. The nature of fungicidal activity is discussed. Prerequisite: Plant Pathology 204 or equivalent; organic chemistry or biochemistry; mycology and microbiology. 1 unit. Offered in 1973-1974 and in alternate years. GOTTLIEB.
404. **Plant Virology.** Fundamental concepts; classification, symptomatology; infectivity; biological, chemical, and physical properties; techniques for transmission, straining, assay, filtration, and purification; control methods; sources of information; history of virology. Prerequisite: Consent of instructor. 1/2 or 1 unit. Offered in 1972-1973 and in alternate years. MILBRATH.
406. **Genetics of Plant-Pathogen Interactions.** The genetics and expression of resistance in plants to fungi, bacteria, viruses, nematodes, and other pathogens; variation and genetic systems in pathogens with particular emphasis on pathogenicity; complementary genetic systems; theory and practice of breeding disease-resistant plants. Lectures, discussions, assigned reading, and term paper. Prerequisite: Plant Pathology 204 and Botany 210, or Agronomy or Horticulture 323, or consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years. HOOKER.
417. **Discussions in Plant Pathology.** Discussion of current research, literature, and other topics pertaining to plant pathology and related fields. 1/4 unit. STAFF.

499. Thesis Research. Individual study and research required of all students working toward the Master of Science or Doctor of Philosophy in Plant Pathology. Prerequisite: Plant Pathology 302 or equivalent. 0 to 4 units. Work can be taken in the following areas, subject to approval of the staff member concerned:

- (a) Biochemistry of Plant Disease.
- (b) Diseases of Corn; Genetics of Resistance. HOOKER.
- (c) Diseases of Cereal Grains. BEVER, HOOKER, SHURTLEFF.
- (d) Diseases of Forest and Shade Trees. CARTER.
- (e) Diseases of Fruit Crops; Fungicides. POWELL.
- (f) Diseases of Leguminous Crops; Root Diseases. GERDEMANN.
- (g) Diseases of Turf and Lawn Grasses.
- (h) Diseases of Soybeans. CHAMBERLAIN, PAXTON, SINCLAIR.
- (i) Diseases of Vegetable and Canning Crops. LINN, SHURTLEFF.
- (j) Nematode Diseases. EDWARDS, MALEK.
- (k) Physiology of Fungi; Antibiotics. GOTTLIEB, SHAW.
- (l) Plant Virology. BLACK, JEDLINSKI.

Polish

(See Slavic Languages and Literatures)

POLITICAL SCIENCE

Department Office: 361 Lincoln Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours from courses offered by the Department of Political Science. A major may include three hours from the following courses: Economics 170, 171 (statistics), Economics 214 (public finance), History 345, 346, 369, 370 (constitutional history), Mathematics 161 (statistics), Psychology 135 (statistics), Sociology 185 (statistics), and three hours of computer science. A maximum of eight hours of 100-level courses may be offered as part of the political science major.

Minors: Twenty hours in one or two of the following subjects with at least eight hours in each if two are chosen: anthropology, economics, education, finance, geography, history, library science, mathematics, philosophy, psychology, social work, speech, and sociology. One of the curricula in Latin-American studies, Russian language and area studies, or medieval civilization is also accepted as a sole minor.

Students entering the University after September 1, 1963, may not offer more than eight hours of 100-level courses as part of a minor, except that Mathematics 123 or higher-numbered mathematics courses are not counted in this limitation.

A special minor is any sole or split minor not listed above. Written approval by the departments is required.

An interdisciplinary topical minor requires a minimum of twenty hours drawn from three or more major departments. It may include courses within or outside the College of Liberal Arts and Sciences. Written approval by adviser and major department is needed.

Departmental Distinction: The Department of Political Science awards graduation with Distinction only to those departmental majors who have completed at least four hours of credit in Political Science 291 or 292 with a grade of "B" or better on the thesis or paper required in that course, who are nominated for graduation with Distinction by the faculty member supervising that course, and who have accumulated a grade-point average of 4.25 or better in political science courses counted toward graduation. Credit received for Political Science 291 or 292 may not be counted toward the minimum (twenty hours) required of political science majors.

Beginning the Study of Political Science: Political Science 150 and 151 give a general

survey of national, state, and local government in the United States. Political Science 191 presents a survey of the basic concepts and methods of political science and of significant current governmental and political problems. Undergraduates beginning the study of political science are advised to take, first, either Political Science 150 or 191. Students planning to do advanced work should, during the sophomore year, take either 150 or 191 and follow it with such other courses as complete one of the following combinations: 150 and 151, 150 and 184, or 184 and 191.

Although the department does not require specific courses, majors should develop programs which introduce them to at least two fields and which provide two or more advanced courses in one of them.

As an aid in recognizing related groups of courses, courses in the department which are in the same general field are roughly grouped by the last two digits of the course number.

The fields and the last two digit numbers are as follows: urban government and politics, X00-X09. For example, municipal government is listed as Political Science 305.

Other fields are: American government and politics, X10-X29; comparative government and politics, X30-X49; public law and jurisprudence, X50-X59; public administration and organization theory, X60-X69; international relations and organization and foreign policy, X70-X89; political theory and philosophy, X90-X99. The major exceptions to the above are the undergraduate seminar reading and the thesis courses, which are numbered 290-293.

110. Government in Illinois. Nature and work of government; governmental units and their interrelations; the Illinois Constitution and problems of revision; popular control of government; organs of state government and local finance. Students are not given credit for both Political Science 110 and 312. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 2 hours. SNIDER.

150. American Government: Organization and Powers: Historical development and organization of national, state, and local governments; the federal system; national and state constitutions; civil and political rights; party system, nature, structure, powers, and procedure of legislative, executive, and judicial departments in state and nation. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of department. 3 hours.

151. American Government: Functions. Functions of national, state, and local governments; foreign relations and national defense; taxation and finance; law enforcement; police power; regulation of commerce, communications, and business; promotion of social and economic welfare; current problems. Students are not given credit for both Political Science 151 and 192. Prerequisite: Political Science 150 or consent of department. 3 hours.

184. International Relations. An examination of the nature of the national state system, of the forces affecting international relations, of the sources of conflicts in international politics, and of their solution by power politics or by international cooperation. 4 hours.

189. Introduction to Political Research. Designed to familiarize students with statistical concepts, research design, and techniques of research as applied to research problems of current interest in political science. 3 hours.

191. Principles of Political Science. The scope and methods of study of political science; basic concepts of political sciences; forces and interests in politics; nature of the state and of government; the legislative, executive, administrative, and judicial processes. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 4 hours.

199. Undergraduate Open Seminar. 0 to 9 hours.

222. Introduction to Modern Africa. Same as African Studies and Anthropology 222. An interdisciplinary, introductory course to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.

241. The Emerging Nations. An introductory comparative consideration of the patterns of

political development and of the policies and problems of the emerging nations of Asia, Africa, and Latin America. Emphasis is on the special characteristics of countries beginning their independent nationhood and the effects of these characteristics on the political systems of these lands and their role in the community of nations. Prerequisite: Three hours of political science or consent of instructor. 3 hours.

245. **Black Political Thought and Movements: U.S.A., Africa, Caribbean.** Political thinkers and movements discussed include W. E. B. DuBois, Panthers, Garveyism, Black Muslims, Nyerere, Harlem Renaissance, Nkrumah Negritude, Caribbean Nationalism, relevant literature to gain knowledge of Black political thought and movements, and use of model construct for the purpose of analysis. Prerequisite: Political Science 150 or consent of instructor. 3 hours.
263. **The Executive Branch of Governments of the United States.** A review of the constitutional, political, and administrative responsibilities of the chief executive and executive agencies in national, state, and local governments in the United States. Prerequisite: Political Science 150 or 191. 3 hours. MONYPENNY.
289. **Seminar in Selected Topics in Political Science.** Selected reading and research in political science. Prerequisite: Junior or senior standing; six hours of political science; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 290.
290. **Honors Seminar.** Research, reading, and discussion in selected topics and works in literature of political science. Prerequisite: Junior or senior standing; six hours of political science; 4.0 average or James Scholar designation; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 289.
291. **Thesis and Honors Course.** Prerequisite: Written consent of instructor; open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours.
292. **Thesis and Honors Course.** Prerequisite: Written consent of instructor; open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours.
293. **Selected Topics in Political Science.** Readings and reports in selected fields chosen in consultation with the instructor. Prerequisite: Written consent of instructor. 1 to 4 hours. May be repeated.
294. **Contemporary Issues and Problems.** Study of a contemporary problem in public policy, domestic or international, to be announced each term the course is offered. Prerequisite: Sophomore standing, three hours of political science, or consent of instructor. 3 hours. May be repeated for credit.
305. **Municipal Government.** Growth of cities; their legal status; municipal politics and organization in the United States. 3 hours, or 1/2 or 1 unit.
306. **Municipal Problems.** Municipal administration in the United States; administrative organization; personnel problems; financial problems; city planning and housing; police and fire administration; public health; public utilities. Prerequisite: Senior standing, or junior standing with Political Science 305 or Economics 102 and 103, or six hours of political science. 3 hours, or 1/2 or 1 unit.
310. **Rural Local Government.** Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; problems of reorganization. 3 hours, or 1/2 or 1 unit.
312. **State Government.** The states in the federal system; state constitutions and problems of revision; organization, powers, and functions of the legislative, administrative, and judicial branches of state government; state functions; reorganization problems in the states; state-local relations; state finance, trends, and prospects. Students are not given credit for both Political Science 312 and 110. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. PISCIOITI.

313. **Comparative State Politics.** Approaches state government from an empirical and behavioral orientation, using contemporary sources. These sources are chosen to introduce current analytical techniques and methods for explicating state politics. The interactions among branches of government along with the impact of policy, interest groups, and constituencies are also analyzed. Prerequisite: Political Science 312, 315, or 328, or consent of instructor. 3 hours, or 1/2 or 1 unit. JOHNSON.
315. **Legislatures and Legislation.** The legislative function in government; structure and organization of American legislatures, national, state, and local; party organization in legislatures; legislative procedure; pressure groups and lobbying; relation of legislature to other branches of government; problems of legislative reorganization. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. JOHNSON, WEINBAUM.
317. **The American Federal System.** The nature, justification, and problems of federalism; coordination of governmental efforts by contract, subsidies, and grants; comparison of federal systems. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. MONYPENNY.
318. **Tax Politics and Administration.** Interactions among the administrative, legal, and legislative aspects of the fiscal decision-making process at federal, state, and local levels. Emphasis is on current issues. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit.
321. **Government and the Economic Order.** A survey of public policies of national and state governments regulating economic activity; transportation, electrical utilities, communications, anti-monopoly, agriculture, level of economic activity. Prerequisite: Any two courses in political science or a combination of political science and economics. 3 hours, or 1/2 or 1 unit.
326. **American Political Parties.** Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention systems; the primary; campaign methods and finance. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or 1/2 or 1 unit. GOLD, WEINBAUM.
328. **An Introduction to the Study of Political Behavior.** An analysis of the interrelations of political attitudes and public formation. Special attention is given to the substantive areas of voting behavior, political leadership, and the rise of political mass movements. The course also includes a review of the literature on democratic and authoritarian personality types. Prerequisite: Political Science 150 or equivalent. 3 hours, or 1/2 or 1 unit. JOHNSON.
329. **Electoral Behavior.** A study of the social and psychological motivations behind the individual voting decision, with special emphasis on the relationships between the voting decision and social stability. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. JOHNSON.
331. **British Government.** Nature of the British Constitution; the Crown, Ministry, and Cabinet; Parliament and elections; the party system; law and the courts; local government; the British Commonwealth. 3 hours, or 1/2 or 1 unit. DAVIS, LEWIS.
335. **Government and Politics of the Soviet Union.** Evolution, structure, and functioning of the Soviet system of government; the theories, structure, and functioning of the Communist party of the Soviet Union. 3 hours, or 1/2 or 1 unit. MILLER.
336. **Governments and Politics in Western Continental Europe.** An analysis of the major governmental systems of continental Europe; the evolution, structure, and functioning of the political institutions of France, Germany, Italy, Spain, Switzerland, and the Scandinavian countries as illustrations of multi-party and dictatorial types of governments. 3 hours, or 1/2 or 1 unit. LEWIS.
337. **Government and Politics of China.** An introduction to the governments and politics of modern China. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. YU.
338. **Government and Politics in the Middle East.** An analysis of the transformation of Middle Eastern society from Morocco to Iran, as case studies in political modernization.

The politics of the area are studied with special reference to causes and character of modernization, role of leadership, ideologies and institutions, methods and theories for analyzing political systems undergoing fundamental transformation, and implications for U.S. policy. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. WEINBAUM.

339. **Governments and Politics of Sub-Saharan Africa.** Analysis of major political systems in Africa south of the Sahara. Emphasis on the development of states and the modification of social and political systems. A general survey of the area is supplemented by a focus on selected countries. Prerequisite: Three hours of political science; consent of instructor. 3 hours, or 1/2 or 1 unit. MCHENRY.
340. **The German Political System.** Structures and processes of postwar German politics, with primary emphasis on West Germany. Special attention is given to foreign policy formulation and problems, particularly defense, the Berlin issue, reunification, and relations with Eastern Europe. Prerequisite: Knowledge of German helpful but not necessary. 3 hours, or 1/2 or 1 unit. MERRITT.
342. **Government and Politics in Latin America.** A survey of the origin and development of Latin-American political institutions; systems of government; public administrative systems; party government; international policies of Latin-American governments. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. BYARS, SCOTT.
343. **Political Systems and Structures of Latin-American Countries.** The political process, generally of selected Latin-American countries at different levels of political development, with stress on the interaction between political infrastructure and more formal agencies of government. May include cross-national comparison of the function of such factors as political culture, party system, bureaucracy, or the military establishment. Prerequisite: Political Science 342. 3 hours or 1/2 unit. BYARS, SCOTT.
345. **Comparative Communist Systems: Eastern Europe.** An analysis of the origins of modern communism and the development of its doctrines; applications of these doctrines in the practices of ruling Communist parties. Emphasis alternates between European and non-European Communist systems, depending on course instructor. 3 hours or 1 unit. MILLER.
346. **Comparative Communist Systems: Asia.** An examination of the origins and development of modern communism in East Asia. Prerequisite: Junior standing. 3 hours or 1 unit. YU.
347. **Governments and Politics of Southeast Asia.** A comparative analysis of the political development of the countries of Southeast Asia, the lands to the east of India and south of China, emphasizing the differing approaches to the governing of man and the formation of public policy to be found in these countries. Economic, social, historical, and geographical influences on political development are considered. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or 1/2 or 1 unit. DOUGLAS.
348. **Government and Politics of Japan.** An introduction to the government and politics of modern Japan. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. WEINSTEIN.
349. **Governments and Politics of South Asia.** A comparative analysis of the political development of India, Pakistan, Ceylon, and the lesser lands of South Asia, emphasizing the differing approaches to the governing of man and the formation of public policy to be found in these countries. Economic, social, historical, and geographical influences on political development are considered. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or 1/2 or 1 unit. COHEN.
350. **Law and Society.** An introductory study from a social science perspective of the nature of law, law makers, and law applies; the causes or inputs determining law; and the effects or outputs which law in general produces. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit. NAGEL.
351. **American Constitutional System.** Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate

commerce; jurisdiction of courts. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. CARMEN, NAGEL.

352. **Comparative Constitutional Law.** A comparative analysis of the constitutional law cases from a variety of countries with particular emphasis on how the cases have resolved issues relating to civil liberties and the allocation of power among governmental bodies. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. CARMEN, NAGEL.
353. **Law and Politics of Poverty.** The study of court cases and other materials dealing with the legal rights and obligations of the poor as tenants, consumers, welfare recipients, employees, arrested persons, family members, legal clients, and political participants. The materials emphasize the constitutional, political, and sociological aspects of the legal rights involved including the political process through which relevant judicial and legislative policy is made and applied. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. NAGEL.
354. **The Judicial Process.** A systematic analysis of legal, evidentiary, environmental, and personal factors that influence judicial decision making, with particular emphasis on the application of the scientific method to the study of judicial behavior. Prerequisite: Political Science 150 and 191. 3 hours, or 1/2 or 1 unit. CARMEN, NAGEL.
355. **The Constitution and Civil Liberties.** A study of free speech, loyalty in a democratic state, citizenship, freedom of religion, rights of persons accused of crime, and government's responsibility to protect persons from racial and religious discrimination, with special attention to the role of law and judges. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. CARMEN, NAGEL.
356. **Public Administration and the Judicial Process.** The scope of administrative powers and their relation to private rights; a comparison of the processes of decision in administrative agencies and in the courts; the interests served by each; the impact of judicial review of administrative decisions upon administrative procedure and policy; the constitutional and statutory bases of review; the legal accountability of public officers versus political accountability. Prerequisite: Political Science 305, 351, or 361, or consent of instructor. 3 hours, or 1/2 or 1 unit. NAGEL.
357. **Law and Politics of Environmental Protection.** The study of court cases, legislation, and social science materials dealing with air, water, noise, and waste pollution and conservation, particularly emphasizing the political factors involved. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. NAGEL.
358. **Effects of Alternative Legal Policies.** The study in a variety of subject matter areas of the actual and potential impact of legislation and judge-made law on the people who are the intended targets of the resulting legal policies. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. NAGEL.
359. **Jurisprudence.** Nature and sources of law; law and the state; law and justice; evolution, arrangement, and subject matter of law. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. MANNER.
361. **Introduction to Public Administration.** Development of administrative organization; administration and the executive, legislature, and judiciary; principles of organization, including line and staff relationships; the staff services of finance and personnel; formal and informal control. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. MONYPENNY, PAGE.
362. **Administrative Organization and Policy Development.** Dynamics of policy formulation in public administrative agencies; current developments in organizational theory and their significance for public administration; origin of public administrative organizations; interpersonal behavior; large-scale organizations and centralization; external support and opposition; policy formation and problems of compliance. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or 1/2 or 1 unit. MONYPENNY, PAGE.
363. **Comparative Administration.** A study of modern bureaucratic organization by means of the comparative method with special reference to the bureaucracies of various coun-

- tries in different stages of industrialization. The course seeks out the cultural bases of administrative behavior. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
- 366. Tools of Public Management.** A critical survey of the tools of analysis available to overhead functions of public management in key areas of decision; emphasis on personnel administration and manpower utilization, budgetary processes and fiscal controls, and several methods of administrative analysis—organizational studies, procedures engineering, information processing, and operations research. Prerequisite: Political Science 361 or consent of instructor. 3 hours or 1 unit. MONYPENNY, PAGE.
- 371. World International Organization.** General development and basic principles of world organization; principles, structure, methods, and actual operation of international governmental institutions; special attention to the United Nations and related agencies and to their evolution from the League of Nations system. 3 hours, or 1/2 or 1 unit. IVERSON.
- 372. Regional International Organization.** Descriptive and comparative analysis of various regional international organizations, their role in contemporary world politics and their relationship to the United Nations system; structure, functions, and accomplishments of the North Atlantic Treaty Organization, Southeast Asian Treaty Organization, Organization of American States, and other regional international organization. 3 hours, or 1/2 or 1 unit. BOCK.
- 377. International Communications.** Same as Communications 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; government-industry relations in communications. 3 hours or 1 unit. MERRITT.
- 380. Comparative Foreign Policies.** An analysis of the formulation and substance of the foreign policies of select nations of the world. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or 1/2 or 1 unit. BOCK.
- 381. American Foreign Relations.** Participation in international affairs; presidential initiative; development and organization of the Department of State; diplomatic intercourse; consular service; treaty-making power; development of foreign policy. Prerequisite: Six hours of political science. 3 hours, or 1/2 or 1 unit. GLAD.
- 382. Contemporary American Foreign Policies.** Study of the major foreign policy decisions currently confronting the United States government: analysis of background, principal issues, alternative actions; formulation of policies. 3 hours, or 1/2 or 1 unit. GLAD.
- 383. Soviet Foreign Policy.** A survey of Soviet foreign policy from 1917 to the present, with emphasis upon the forces shaping this policy. Special attention is given to the interplay of ideology and national interest in policy formulation. 3 hours, or 1/2 or 1 unit. MILLER.
- 384. International Relations.** An examination of contemporary international systems in terms of the types of actors and their goals, various structures of power, and the mechanisms of allocating resources and containing conflict. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit. GLAD, MERRITT.
- 385. International Law.** Nature, source, and development of international law and certain basic rights and obligations of the subjects thereof. Prerequisite: Senior standing, or junior standing with six hours of political science. 3 hours, or 1/2 or 1 unit. MANNER.
- 386. International Law.** Responsibility, intercourse, and redress of differences between states. Prerequisite: Senior standing, or junior standing with six hours of political science. 3 hours, or 1/2 or 1 unit. MANNER.
- 387. National Security Policy.** An examination of the organization and formulation of current American defense policy; the theory and practice of deterrence, with special reference to American and Soviet military strategy; and the problems of disarmament and arms control. 3 hours, or 1/2 or 1 unit. COHEN, LEWIS.
- 388. The Military and Politics.** The role of the military in national and international policies, with special attention given to theories of war and peace, civil-military relations, the military and the political development of Western and non-Western states, and the

- nonmilitary uses of the military. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or 1/2 or 1 unit. COHEN.
389. **Chinese Foreign Policy.** An analysis of the formulation, substance, and conduct of Chinese foreign policy, with emphasis on the period since 1949. Special attention is given to the forces shaping Chinese policy. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or 1/2 or 1 unit. YU.
390. **Methods of Political Analysis.** Presentation of the analytic processes in the development of concepts, hypothesis, and theories; discussion of the derivation, formulation, and specification of research problems to be related to basic methodologies and modes of analysis; applications to political science. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or 1/2 or 1 unit. HOBBS.
392. **Socialist Political Theory.** Origins, development, and recent modifications of socialist theory from the late eighteenth century to the present. The course examines each contribution in terms of its goals, efficacy, and subsequent influence. Discussion includes Rousseau, Hegel, the Utopians, Marx and Engels, Anarcho-syndicalists, Lenin, Luxemburg, Trotsky, Mao, Guevara, Garaudy. Prerequisite: Sophomore standing. 3 hours or 1 unit. CARROLL.
393. **Classical Political Theory.** A consideration of major works of Greek and Roman political theory, and especially of their relevance to modern political analysis and action. 3 hours, or 1/2 or 1 unit. DAVIS.
394. **Medieval Political Theory.** The development of political theory from the Church Fathers to the sixteenth century: Augustine, Thomas Aquinas, Dante Alighieri, Marsiglio of Padua, Machiavelli, Thomas More, and others; conflicts of church and state, theories of natural law, natural rights, kingship, legitimacy, popular sovereignty, and representative government. 3 hours, or 1/2 or 1 unit. CARROLL.
395. **Modern Political Theory.** A critical analysis of political theories from the sixteenth century to the present. The focus is on the development of such concepts as the nature of man, the role of the state, justice, legitimacy, obligation, individual rights, equality, and mechanisms of maintenance and change. 3 hours, or 1/2 or 1 unit. FIELD.
396. **Contemporary Political Theory.** Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; antidemocratic thought and totalitarian regimes. 3 hours, or 1/2 or 1 unit. SCHILLER.
397. **American Political Theory.** A survey of American political thought from colonial times to the present. 3 hours, or 1/2 or 1 unit. SCHILLER.
398. **Theory and Practice of Democratic Government.** Theories of the nature and conditions of democracy; contemporary democratic institutions compared and analyzed. Prerequisite: Political Science 150 or 191. 3 hours, or 1/2 or 1 unit. FIELDS.
400. **Classics of Political Science.** Reading, analysis, and discussion of leading works on politics and government. 1 unit.
401. **History of Political Theories.** Reading and analysis of the leading political thinkers from the Greeks to the middle of the seventeenth century. 1 unit. DAVIS.
402. **History of Political Theories.** Readings and analysis of the leading political thinkers from the middle of the seventeenth century to the present. 1 unit. FIELDS.
406. **Municipal Administration.** Position of cities in American governmental systems; governmental interrelationships; powers; services; current municipal problems. 1 unit.
410. **Problems in Rural Local Government.** Research in selected topics. 1 unit.
412. **Problems in State Government.** Research in selected topics in American state government. 1 unit. GOVE.
420. **Formation of Public Policy.** Same as Labor and Industrial Relations 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, judicial activity. 1 unit. RUNDQUIST.

423. **Proseminar in American Politics.** An intensive analysis of major institutions and processes of American politics, national, state, and local; research on selected topics in American government. 1 unit. MONYPENNY, WEINBAUM.
425. **Personality and Political Process.** Rationality and its limits in political processes; the functions of symbols and myth in politics; political involvement and quiescence; nonrational elements in legislation and administration. 1 unit. Prerequisite: Consent of instructor. COOMBS.
426. **Political Parties.** Special problems in political parties; methods and materials of research in this field. 1 unit. WEINBAUM.
427. **Psychological Base of Political Behavior.** This course is intended to introduce the student to relations between psychological mechanisms and life history factors and individual or group political behavior. Topics covered include national loyalty and ideology, mass public and political involvement, political authority, and individual compliance. 1 unit. COOMBS.
428. **Multivariate Analysis for Political Scientists.** Applied use of extended analysis of variance, Multiple classification analysis, factor and small space analysis, causal analysis, multiple regression and selected topics to research. Prerequisite: Sociology 413 or 387, and Political science 497, or consent of instructor. 1 unit. JOHNSON.
430. **Proseminar in Comparative Politics.** Comparative political analysis in the context of the evolution of the social sciences and modern political science, with emphasis on theories of political action and their function in contemporary comparative studies. This course is designed as an introduction to area oriented seminars and generally is a prerequisite for them. 1 unit.
431. **Problems of British Government.** Special topics relating to British government. 1 unit. LEWIS.
435. **Problems in the Government of Soviet Russia.** Special topics relating to the government of the Soviet Union. 1 unit. MILLER.
437. **Problems in Chinese Politics and Government.** Research in selected topics relating to the political system of China. Prerequisite: Credit or registration in Political Science 430, or consent of instructor. 1 unit. May be repeated for credit not to exceed 2 units. YU.
439. **Problems of African Politics and Government.** Analysis of political problems of African states. 1 unit. May be repeated for credit not to exceed 2 units. MCHENRY.
440. **Comparative Politics and the Political Process.** The comparative study of selected national political systems or of specific institutional forces that influence the making and application of public policy in several countries. The countries studied and the legal and extra-legal political agencies considered vary according to the person conducting the seminar. 1 unit. May be repeated for credit not to exceed 3 units. STAFF.
441. **Politics in the Developing States.** An examination of the political processes in the developing countries. The general problems arising in the transition from traditional societies to modern industrial states are examined to describe the typical patterns of political change. Special attention is given to contemporary literature and studies. Prerequisite: Political Science 430; consent of instructor. 1 unit. SCOTT.
442. **Problems of Latin-American Politics and Government.** Special topics relating to Latin-American politics and government. Individual countries may be studied or comparative analysis of particular political and governmental functions or problems may be undertaken. Prerequisite: Political Science 430 or equivalent. 1 unit. May be repeated for credit not to exceed 2 units. SCOTT.
446. **Problems of Southeast Asian Politics and Government.** Research in the political systems of Southeast Asia. Prerequisite: Credit or registration in Political Science 430, or consent of instructor. 1 unit. May be repeated for credit not to exceed 2 units. DOUGLAS.
448. **Problems in Japanese Politics and Government.** Study of scholarly literature on modern Japanese politics and examination of selected problems in modern Japanese politics. Prerequisite: Credit or registration in Political Science 430, or consent of instructor. 1 unit. May be repeated for credit not to exceed 2 units.

449. **Problems of South Asian Politics and Government.** Research in the political systems of South Asia. Prerequisite: Credit or registration in Political Science 430, or consent of instructor. 1 unit. May be repeated for credit not to exceed 2 units. COHEN.
450. **Contemporary Governmental Problems.** Special problems of current importance. Designed especially for students not majoring in political science. 1 unit. May be repeated for credit not to exceed 3 units.
451. **Constitutional Law.** Research in selected topics in the American constitutional system. Prerequisite: Political Science 351 or equivalent. 1 unit. CARMEN, NAGEL.
453. **Law, Policy, and Social Science.** The application of social science research techniques to improving legal procedure and legal substance. Emphasis is placed on constitutional law and other public law subjects, but other fields of law are also considered. 1 unit. NAGEL.
460. **Organizational Sciences, I.** Same as Business Administration 410, Psychology 453, and Sociology 456. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program of approval of instructor. 1 unit.
461. **Organizational Sciences, II.** Same as Business Administration 411, Psychology 454, and Sociology 457. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Political Science 460. 1 unit.
465. **Problems in Administrative Management.** An analysis of methods of applying administrative principles and procedures to operating problems in government agencies, such as methods of administrative coordination and control, intergovernmental cooperation, legislative-administrative relations, the organization of regulatory functions, and review of administrative decisions. Prerequisite: Political Science 361 or consent of instructor. 1 unit. MONYPENNY, PAGE.
466. **Current Administrative Theory.** A discussion of some recent trends in administrative opinion and practice on such questions as agency structure and functional activities; field and regional organization and relations; the role and functions of the executive; the process of decision making; the relations of line and staff activities; the communication and execution of policies and programs; and employee relations. 1 unit. MONYPENNY, PAGE.
469. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations, Social Work, Educational Administration 497. Development of employee organization, collective bargaining, and public policies in the public sector—federal, state, and local. Analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
471. **Problems in International Organization.** Methods and materials of research in international organization; special topics, such as disarmament, security, procedural problems in the United Nations, economic and social problems, amendment and revision of the Charter. 1 unit. BOCK.
480. **Scope and Theory in International Relations.** Deals with the field of international relations, its relationship to political science and the other social sciences. Treats the development of the field by examining major theories and approaches that have characterized it in the past, but with emphasis on contemporary theories and concepts. 1 unit.
481. **Methodology in International Relations.** Deals with major research methodologies in contemporary international relations, including case studies, aggregate data, content analysis, survey research, gaming and simulations, and causal modelling. Presumes knowledge of basic international relations theory. Prerequisite: Political Science 480. 1 unit.

- 482. Foreign Relations of the United States.** Special problems in the development and conduct of American foreign policy. 1 unit. GLAD.
- 483. United States Foreign Policies.** Study of selected current problems in foreign policy; use of power; problems of negotiation; relations with new states; foreign aid. 1 unit. GLAD.
- 484. International Relations: Special Problems in Theory and Research.** Advanced seminar on special topics in international relations. Prerequisite: Political Science 480 or 481, or consent of instructor. 1 unit. May be repeated under different instructors up to 3 units of credit.
- 484. International Relations.** An analysis of the approaches and methods used in the study of international relations; the characteristics of states and of international systems; the problem of conflict and its resolution. 1 unit. May be repeated under different instructors up to 3 units of credit. GLAD, MERRITT.
- 485. International Law.** Research on selected topics. 1 unit. MANNER.
- 490. Proseminar in Political Behavior.** Interdisciplinary approaches to the analysis of political behavior; formation of opinions, interests, roles, and personality; applications of organization theory to political institutions; applications of conflict and bargaining theory to political processes; systematic studies of the distribution of values. 1 unit. COOMBS, HOBBS.
- 491. Proseminar in Political Behavior.** Interdisciplinary approaches to the analysis of political behavior; formation of opinions, interests, roles, and personality; applications of organization theory to political institutions; applications of conflict and bargaining theory to political processes; systematic studies of the distribution of values. Prerequisite: Political Science 490. 1 unit. COOMBS, HOBBS.
- 492. Problems of Explanation in Social Science.** Special topics in the methodology of social sciences, especially theory formation, theory testing. 1 unit. HOBBS.
- 493. Research in Selected Topics.** Research in selected topics by arrangement with the instructor. 1/2 to 3 units. STAFF.
- 494. Systematic Social Criticism.** Problems of social criticism in contemporary society; relation of social criticism and social policies. Prerequisite: Political Science 492 or consent of instructor. 1 unit.
- 495. Scope and Methods of Political Science.** Definitions of the scope and subject matter of political science; methodological issues in political science; major conceptions of methodology as embodied in current leading studies of politics; the present state of research in political science. 1 unit. HOBBS.
- 496. Political Concepts: Formulation and Measurement.** The course is designed to indicate the relevance of certain research techniques for answering questions of concern in political science and to indicate the range of tools available to the student. Problems in concept formation are discussed. Current methods of concept measurement are presented to the student in the context of political research problems. Prerequisite: Consent of instructor. 1 unit. JOHNSON.
- 497. Research Design and Techniques.** This course is intended to introduce the student to problems of research design, data collection, data analysis and interpretation, sampling, and some simple measures of statistical association and significance. Prerequisite: Political Science 496. 1 unit. JOHNSON.
- 498. The Logic of Political Inquiry: Selected Topics.** Application of analytic principles and procedures developed in Political Science 495 to such topics as patterns of explanation; current theoretical perspectives; group theory, functionalism, systems theory, decision making, simulation, etc; the logic of judicial decisions; justifications of political ideologies. This list is not exhaustive; nor will all of these topics be included each semester. Prerequisite: Political Science 495. 1 unit. May be repeated for credit not to exceed 2 units. HOBBS.
- 499. Thesis Research.** 0 to 4 units.

Portuguese

(See Spanish, Italian, and Portuguese)

PSYCHOLOGY

Head of Department: Professor J. E. McGRATH

Department Office: 315 Psychology Building

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Three types of major programs are offered: The general major, suitable for students interested primarily in general liberal education; the applied psychology major, designed for students interested in vocational preparation involving a minimum of graduate training; and the graduate preparatory major, designed mainly to prepare students for graduate training leading to the doctorate in psychology.

The general major must complete twenty hours in psychology beyond Psychology 100, 103, or 105. Psychology 135 is required in this program and should be taken as soon as possible after the introductory course. The twenty hours beyond the introductory course must include at least six hours from each of the two following areas: Area I: Psychology 211, 217, 230, 248, 311, 326, 330, 331, 335, 345, 346, 348; Area II: Psychology 201, 216, 245, 250, 332, 338, 350, 351, 352, 355, 359, 371, 373, 390. With the instructor's approval, Psychology 198, 199, 293, or 294 may be included in Area I or Area II.

The applied psychology major can specialize in any one of three different options, namely, engineering psychology, personnel psychology, and measurement psychology. The requirements for engineering psychology are as follows: Psychology 235, 245, 356, 258; 12 hours selected from Psychology 330, 331, 332, 390; Computer Science 103; Physiology 305. The requirements for Personnel Psychology are as follows: Psychology 235, 245, 332, 355, 390; six hours selected from Psychology 201, 250, 258, 356, six hours selected from Accountancy 201, Business Law 261, Economics 102, 103, 300, Industrial Engineering 287, Sociology 300; Computer Science 101 or 103. The requirements for psychological measurement are as follows: Psychology 100, 103, or 105; Psychology 235, 245, 390; three hours selected from Psychology 216, 250, 338; eight hours selected from Psychology 330, 331, 332; three hours selected from 217, 230, or 248; either Computer Science 101 or 103.

The graduate preparatory major must complete twenty hours in psychology beyond Psychology 100, 103, or 105. Psychology 235 and eight hours of work in laboratory courses at the 300-level are required in this program. The twenty hours beyond the introductory course must include at least six hours from each of the following areas: Area I: Psychology 211, 217, 230, 248, 311, 326, 330, 331, 335, 345, 346, 348; Area II: Psychology 201, 216, 245, 250, 332, 338, 350, 351, 352, 355, 359, 371, 373, 390. With the instructor's approval Psychology 198, 199, 293, or 294, may be included in either Area I or Area II. Graduate preparatory majors are also urged to take mathematics through calculus, at least a full-year laboratory course in another science, and at least two years of French, German or Russian, with two years in each of two desirable.

Minor: For the general major, 20 hours in any subject matter accepted for credit by the College of Liberal Arts and Sciences; if two are chosen there must be a minimum of eight hours in each. In addition, if foreign language credit is offered, it must be beyond that required by the college for graduation.

For the applied psychology major, the minor must be selected in accordance with the major option. For engineering psychology, a minor or minors of 20 hours selected from mathematics, engineering, physics, and physiology. For personnel psychology, a minor or split minor of twenty hours selected from mathematics, anthropology, economics, political science, and sociology. For psychological measurement, a minor of 20 hours in mathematics which includes Mathematics 315.

For the graduate preparatory major, twenty hours in one or two of the following subjects, providing that if two are chosen, there must be a minimum of eight hours in each: anthropolo-

gy, any biological science, chemistry, economics, education, engineering, linguistics, mathematics, philosophy, physics political science and sociology.

Departmental Distinction: The minimum requirements for graduation with departmental distinction in psychology are as follows: A 4.33 grade-point average in psychology courses, satisfactory completion of the courses required in the graduate preparatory major program, and four hours of credit in Psychology 291-292, the honors program seminar, including an acceptable bachelor's thesis.

100. **Introduction to Psychology.** The study of human behavior with special reference to perception, learning, memory, thinking, emotional life, and individual differences in intelligence, aptitude, and personality. Emphasis is placed upon the scientific nature of psychological investigations. Research methods are discussed and results are related to daily life and everyday problems. Lectures, quiz meetings, and five hours of participation in laboratory experiments. Not open to students electing Psychology 103 or 105. 3 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
101. **Theory and Practice of Psychological Research.** Consideration of research methods and problems of research design in psychology. Participation in ongoing research of the staff of the department. Prerequisite: To be taken concurrently with Psychology 100, 103, or 105, or with the consent of the academic adviser of the Department of Psychology. 1 hour. May not be repeated.
103. **Introduction to Experimental Psychology.** Lecture and laboratory. An in-depth survey of basic topics in experimental psychology. Lectures emphasize conditioning, learning, perception, and animal behavior with stress placed on the biological aspects of these problems. 3 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
105. **Elements of Psychology.** A description and explanation of the psychological principles of everyday living, with emphasis on how behavior is motivated, how individuals learn intelligent behavior, personality, and applications of psychology to various social issues. Lectures, discussions, and five hours of participation in psychological experiments. This course may be substituted for Psychology 100 when the latter is listed as a prerequisite or a recommended elective. For placement purposes, enrollment is limited to students whose ACT composite score is 21 and below. Not open to students electing Psychology 100 or 103. 4 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
135. **Statistical Thinking in Psychology.** The application of principles of descriptive and inferential statistics to psychological phenomena. Credit is not given for Psychology 135 in addition to Economics 171, Mathematics 161, or Psychology 235. Prerequisite: Psychology 100, 103, or 105. 3 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication and social organization, and parental, sexual, and aggressive behavior. 3 hours.
198. **Freshman Seminar in Psychology.** Lecture-discussions devoted to the in-depth study of a topic of current interest in psychology. The specific topic studied is elected by the students from those topics falling within the area of competence of the instructor. The instructor rotates from one semester to another so that the general area changes as the instructor changes. Prerequisite: Open only to James Scholars. There may be additional prerequisites from time to time as the topic of the seminar changes. For example, there may be a mathematics prerequisite for a seminar in mathematical psychology or a biological science prerequisite for a seminar in physiological psychology. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Social Psychology.** The systematic study of social factors in individual and group behavior. Particular attention is given to social perception, motivation, and learning; attitudes, norms, and social influences processes; the development and dynamics of groups, and the effects of social and cultural factors on the individual. Credit is

- not given for both Psychology 201 and Sociology 201. Prerequisite: Psychology 100, 103, or 105. 3 hours.
202. **The Application of Social Psychology to Contemporary Issues.** An exploration of selected social issues, using the methodological and conceptual viewpoints of social psychology as analytical tools. Different sections cover different topics as listed in the Time Table. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 211. **Physiological Psychology.** A survey of classical and modern concepts of the physiological basis of behavior. Particular emphasis is given to the sensory systems, regulatory mechanisms, and learning. Prerequisite: Psychology 100, 103, or 105; Physiology 103 or 106, or Zoology 101. 4 hours.
 216. **Child Psychology.** A study of the psychological development of the child. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 217. **Comparative Development.** A survey of phylogenetic and ontogenetic development of behavior. The first part of the course considers the comparative psychology of representative phyla, with special emphasis on the development of sensorimotor coordination, motivation, and learning. The second half of the course is concerned with development of behavior in the individual organism, with most attention being devoted to behavioral changes during the life span of vertebrate organisms. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 230. **Perception and Sensory Processes.** A survey of the experimental psychology of sensory and perceptual processes and behavior. The course emphasizes the contribution of behavior science to understanding subjective experience of the physical and social environment. Prerequisite: Psychology 100, 103, or 105; consent of instructor or academic counselor of the Department of Psychology. 3 hours.
 235. **Statistical Methods in Psychological Research.** Development of skill and understanding in the application of statistical methods to problems of psychological research. Prerequisite: Psychology 100, 103, or 105; Mathematics 111 or equivalent; consent of instructor or academic counselor of the Department of Psychology. 4 hours. Students who have credit in Economics 171, Mathematics 161, or Psychology 135 receive 1 hour credit.
 245. **Industrial Psychology.** A systematic study of the application of psychological methods and principles in business and industry, with emphasis upon personnel selection and factors influencing efficiency. Prerequisite: Psychology 100, 103, or 105; a course in statistics. 3 hours.
 246. **Vertebrate Social Organization.** Same as Anthropology, Sociology, and Zoology 246. An introduction to the biosociology of the vertebrates. Emphasis on the behavioral, psychological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
 248. **Learning.** A survey of basic phenomena in learning, emphasizing experimental data from both animal and human research. Prerequisite: Psychology 100, 103, or 105; consent of instructor or the academic counselor of the Department of Psychology. 3 hours.
 250. **Psychology of Personality.** A systematic study of the development, dynamics, and structure of personality, including major contributions to methodology, theory, and empirical research. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 258. **Human Performance in Man-Machine Systems.** An examination of equipment and training variables that influence the human operator in man-machine systems. Main topics: nature of man-machine systems; capabilities of men and machines; simulation for design decision; task analysis methods to determine human requirements in a system. Research and principles for the design and use of symbolic and pictorial displays, control systems, and simulators for training. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 291. **Honors.** Prerequisite: Junior standing; consent of instructor. 2 to 4 hours.
 292. **Honors.** Prerequisite: Psychology 291. 2 to 4 hours.
 293. **Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional

cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point of 3.75. 2 to 4 hours.

294. **Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point average of 3.75. 2 to 4 hours.
306. **Quantitative Methods, I.** A lecture and laboratory course in the development and application of quantitative methods in psychological research. Prerequisite: Twelve hours of psychology, including Psychology 135 or equivalent. 4 hours or 1 unit.
307. **Quantitative Methods, II.** Continuation of Psychology 306. Prerequisite: Psychology 306. 4 hours or 1 unit.
311. **Laboratory in Physiological Psychology.** Research in classical and current problems with emphasis on the nervous and endocrine systems in information processing and in the regulation of behavioral adaptation, with examples from sensation, perception, motivation, emotion, and learning. Laboratory. Prerequisite: Psychology 211; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or 1/2 or 1 unit.
326. **Motivation and Emotion.** The nature and development of emotion, attitude, motive, and the role of these processes in social adjustment. Prerequisite: Six hours of psychology. 3 hours, or 1/2 or 1 unit.
330. **Experimental Psychology, I.** A survey of problems, experimental methods, and research findings in the fields of psychophysics, sensory processes, perception, judgment, and thinking. Prerequisite: Psychology 230; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or 1/2 unit.
331. **Experimental Psychology, II.** A lecture-laboratory course concentrating on research problems and methodology in both animal and human learning. Students concentrate on laboratory techniques and reporting experimental results. Prerequisite: Psychology 248; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or 1/2 unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Sociology 332. A lecture and laboratory course in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 and Sociology 184 and 185; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or 1/2 or 1 unit.
333. **Research Methods in Social Psychology: Natural Settings.** Methods and techniques of social psychological research in natural settings. Students formulate and carry out research problems using procedures appropriate for research in natural settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185; consent of instructor or academic counselor of the Department of Psychology. 4 hours or 1 unit.
335. **Mathematical Formulations in Psychological Theory.** Mathematical formulations are illustrated by studying quantitative treatments of various psychological processes. Emphasis is on learning theory, psychophysical laws, and other selected topics. Simple mathematical tools are developed as required. Prerequisite: Elementary statistics of probability, elementary calculus, and six hours of psychology, or consent of instructor. 3 hours, or 1/2 or 1 unit.
338. **Abnormal Psychology.** An introduction for preprofessional students to the psychological aspects of the behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. Prerequisite: Six hours of psychology; junior standing except for those in the premedical curriculum who may take the course as second-semester sophomores with four hours of psychology. 3 hours, or 1/2 or 1 unit.
339. **Community Psychology.** An introduction to the concepts and the application of psychological knowledge to community problems. A broad definition of mental health, a social learning, and a preventive, rather than an ameliorative, approach to community problems is stressed. Emphasis is on community organization and innovations in the delivery of services to those populations which normally fall outside the service network, e.g., the

poor, minority groups, and other "marginal men." Prerequisite: Sophomore standing; Psychology 100, 103, or 105. 3 hours, or 1/2 or 1 unit.

345. **Comparative Psychology.** Animal behavior with particular reference to the behavior of vertebrates. Prerequisite: Six hours of psychology, or Psychology 100, 103, or 105; a course in zoology. 4 hours, or 1/2 or 1 unit.
346. **An Introduction to Behavior Genetics.** Same as Anthropology 336. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; survey of research and possible extensions of research on behavior-genetic correlates. Students may take Psychology 347 with this course. Prerequisite: A course in statistics; a course in biology, or Anthropology 240, or Psychology 100, 103, or 105. 3 hours, or 1/2 or 1 unit.
347. **Behavior Genetics Laboratory.** Same as Anthropology 337. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Consent of instructor or academic counselor of the Department of Psychology; Psychology 346 must be taken concurrently with this course. 2 hours or 1/2 unit.
348. **Theories of Learning.** A critical analysis of selected theories of learning. Problems of theory construction are considered in the context of past controversies in learning as well as recent theories of animal and human learning. Prerequisite: Psychology 248 or Educational Psychology 211. 3 hours, or 1/2 or 1 unit.
350. **Research and Theory in Personality.** The study of personality for the advanced student in psychology. The problems of measurement, development, structure, dynamics, and change of personality are considered. Examples of current theory and research are studied as illustrations of an objective approach to the field. Prerequisite: Psychology 100, 103, or 105; Psychology 235 or equivalent. 3 hours, or 1/2 or 1 unit.
352. **Attitude Theory and Change.** Same as Communications and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change. Emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Psychology 201 or Sociology 201, or a comparable course of introduction to social psychology. 3 hours, or 1/2 or 1 unit.
353. **Individual Social Behavior.** A survey of major theories and research on perceptual, cognitive, learning, motivational, and environmental factors that influence the social behavior of the individual. Prerequisite: Psychology 201; Psychology 216; or Psychology 250, or consent of instructor. 3 hours or 1/2 unit.
354. **Interpersonal Processes.** The nature of interpersonal transactions, and theories and methods for their investigation. Both individual and social determinants of such transactions are considered. Prerequisite: Psychology 201. 3 hours, or 1/2 or 1 unit.
355. **Industrial Social Psychology.** Same as Labor and Industrial Relations 355. Social psychological research and theory applied to industrial problems. Emphasis on interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or 1/2 or 1 unit.
356. **Human Factors in System Design.** An evaluation of the capabilities and limitations of human operators in the design of man-machine systems. Applications of signal detection theory, information theory, servo theory, and Bayesian statistics to human sensing, monitoring, decision making, information processing, and communicating capabilities. Prerequisite: Psychology 258; one course in statistics or equivalent. 3 hours or 1 unit.
357. **Psychology of Industrial Conflict.** Same as Labor and Industrial Relations 357. An analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Offered in the special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or 1/2 or 1 unit. Undergraduate majors in psychology may not receive credit in this course.
359. **The Social Psychology of Organization.** Same as Sociology 359. Analysis of the interrelationships between social and psychological factors, on one hand, and organizational structure and process on the other. Emphasis on sources, consequences, and modes of

resolution of intraindividual, intraorganizational, and interorganizational conflict. Prerequisite: Psychology 355 or Sociology 332. 3 hours or 1 unit.

360. **Modern Viewpoints in Psychology.** A brief survey of early theoretical psychology is followed by an examination of contemporary "behavior theory," Gestalt theory, and psychoanalytic theory—as concepts of man and as approaches to the study of learning, perception, personality, and social behavior. Prerequisite: Senior standing, nine hours of psychology with an average grade of "B," with consent of instructor. 3 hours, or 1/2 or 1 unit.
361. **Advanced Developmental Psychology.** Theory and research on psychological development from birth through adolescence; maturation of behavior systems; the role of social learning in development; the effects of early experience on personality development; critical stages in development. Prerequisite: Psychology 216 or 217; a course in statistics. 3 hours, or 1/2 to 1 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health, Education, Physiology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 to 5 hours.
371. **Psychological Factors in Political Science.** An application of psychological methods and theories to the study of political behavior. Special attention is devoted to research methods and to content problems in voting behavior and national security policy. Prerequisite: Six hours beyond 100-level courses in psychology, political science, or sociology. 3 hours or 1/2 to 1 unit.
373. **Theory and Method in the Cross-Cultural Study of Individual Social Behavior.** Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception. Methodological limitations and contributions of cross-cultural study are emphasized. Current problems and research are discussed. Prerequisite: Six hours of psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Psychology 369. 4 hours or 1 unit.
390. **Psychological Tests and Measurements.** The measurement of human behavior in psychological studies; the construction and use of psychological tests; introduction to tests of intelligence, achievement, personality, and interest; practice in test construction, administration, and validation. Lectures and laboratory. Prerequisite: A knowledge of statistics equivalent to that from Psychology 235. 4 hours or 1 unit.
393. **Laboratory in Primate Social Behavior.** Same as Anthropology and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior. Instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or 3/4 or 1 unit.

Note: The prerequisites stated below apply to graduate majors in psychology. Students minoring in psychology may, by special permission of instructors, enroll in certain of these courses without having met all the prerequisites.

402. **Systematic Psychology.** A critical analysis and comparison of modern and contemporary psychological systems. Prerequisite: Twelve hours of psychology. 1 unit.
403. **Proseminar in General Psychology, I.** A brief historical introduction to modern psychol-

- ogy; fundamentals of differential psychology, including the measurement of intelligence, aptitudes, and personality; motivation, emotion, and mechanisms of defense; psychological development; social behavior. Prerequisite: Twelve hours of psychology. 1 unit.
404. **Proseminar in General Psychology, II.** Sensory processes; perception; fundamental processes in learning; learning theory; special aspects of human learning; language behavior; thinking; logical aspects of psychological theory. Prerequisite: Twelve hours of psychology. 1 unit.
408. **Design of Experiments in Psychology.** Advanced experimental designs in psychological research; special methods of data analysis. Prerequisite: Psychology 307. 1 unit.
409. **Psychological Scaling.** Same as Sociology 409. Scaling theory and methodology, with emphasis on measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit.
411. **Advanced Physiological Psychology.** Detailed examination of the physiological mechanisms in behavior. Research methodology and contemporary literature in the physiology of motivation; learning, perception, and emotion are emphasized. Laboratory demonstrations and problems. Prerequisite: Twelve hours of psychology, including Psychology 311 or equivalent. 1 unit.
413. **Computer Applications in Social Statistical Research.** Same as Computer Science and Sociology 413. Computer procedures for the analysis of sociological and psychological data, including probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387. 1 unit.
414. **Experimental Personality Research.** A laboratory training course emphasizing physiological, perceptual, learning, and genetic approaches to the experimental study of personality. Critical surveys of recent research literature are combined with laboratory training in representative techniques. Prerequisite: Psychology 307 and 404; consent of instructor. 1 unit.
415. **Experimental Sensory Psychology.** A systematic study of sensory processes, including vision, audition, gustation, olfaction, and somesthesia. Experimental methods, research findings, and theory are emphasized. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.
416. **Perception.** Systematic study of methods and research findings in the field of human perception, together with an evaluation of theoretical interpretations. Prerequisite: Twelve hours of psychology. 1 unit.
417. **Experimental Psychology of Learning, I: Basic Processes.** A study of experimental investigation of basic learning processes, with emphasis upon the nature of the problems, experimental procedures, and theoretical significance. Prerequisite: Twelve hours of psychology. 1 unit.
418. **Experimental Psychology of Learning, II: Human Learning.** Data and theories of verbal learning; verbal mediators and their functions in learning and retention; transfer of training; short-term and long-term memory; conceptualizations of the forgetting process. Prerequisite: Twelve hours of psychology or consent of instructor. 1 unit.
419. **Advanced Comparative Psychology.** A critical survey of techniques, results, and problems in the study of animal behavior and human behavior from the comparative-evolutionary point of view. Laboratory demonstrations and individual research problems. Prerequisite: Twelve hours of psychology or biology. 1 unit.
421. **Problems in Motivation.** Prerequisite: Twelve hours of psychology. 1 unit.
424. **Developmental Psycholinguistics.** Same as Communications and Linguistics 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Communications and Linguistics 425. A critical survey of methods and theories in the psychological study of the communication process, with emphasis upon linguistic, information-theory and learning-theory approaches, psycho-

linguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.

- 426. Research Seminar in Psycholinguistics.** Same as Communications and Linguistics 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course plan, execute, and report an original piece of research in this area. Prerequisite: Psychology 425; consent of instructor. 1/2 or 1 unit.
- 427. Engineering Psychology.** Experimental psychology applied to the study of man-machine systems. Study of psychological factors in the design of equipment, systems, and environments for safe, efficient, and comfortable performance by man. 1 unit.
- 428. Higher Process.** An examination of method, theory, and research in the study of thinking; status of cognition as a construct; verbal control of behavior; concepts, problem solving, attention, language and thought; cognitive process as a source of motivation. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.
- 429. Second Language Acquisition and Bilingualism.** Same as Linguistics 429. An examination of the field from a psycholinguistic perspective. The following topics are discussed: first vs. second language acquisition, the nature of language aptitude and competence, methods of second language teaching, the nature of bilingualism, and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit.
- 431. Psychological Measurement in Industry.** Application of psychometric methods and the findings of differential psychology to the selection, classification, and performance evaluation of industrial personnel. Prerequisite: Psychology 307 or equivalent. 1 unit.
- 435. Motivation and Morale in Industry.** Same as Labor and Industrial Relations 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
- 436. Mathematical Models in Psychology.** Recent developments in mathematical models in psychology. Special emphasis is given to human learning, higher processes, and modern psychophysics. Prerequisite: One year of calculus and Psychology 306 and 307, or consent of instructor. 1/2 or 1 unit.
- 438. Introduction to Clinical Psychology, I.** Introduction to clinical psychology as science and profession. Lectures, discussions, demonstrations, and field observations are provided for overview of clinical psychology. Prerequisite: Graduate standing in clinical psychology; consent of instructor. 1 unit.
- 439. Introduction to Clinical Psychology, II.** Continuation of introductory sequence in clinical psychology. Logical issues in assessment, disposition and behavior change are discussed. Preliminary training in interview and observational methods are initiated. Prerequisite: Psychology 438. 1 unit.
- 440. Functional Analysis of Behavior.** A lecture and laboratory course in the principles, analysis, and control of behavior with emphasis on operant and respondent conditioning as means of behavior change. Prerequisite: Consent of instructor. 1/2 unit.
- 441. Personality and Behavior Dynamics.** The cross-sectional structure of personality, the basic principles of behavior dynamics and the determinants which shape personality development are described. Special topics include typologies, trait measurement, conflict and anxiety, and mechanisms of defense. Graduate credit is not allowed for both Psychology 350 and 441. Prerequisite: Twelve hours of psychology. 1/2 unit.
- 442. Behavior Disorders.** A review of the experimental-clinical literature concerning the behavior disorders, with special reference to their classification and etiology. Prerequisite: Psychology 338 and 440; consent of instructor. 1/2 unit.
- 443. Psychodiagnostics, I.** Instruction and practice in the administration and interpretation of individual tests of general intelligence, special abilities, and achievement. Prerequisite: Twelve hours of psychology, including Psychology 390 or equivalent; Psychology 439. 1 unit.

444. **Psychodiagnostics, II.** Instruction and practice in the administration and interpretation of tests and other instruments used in the assessment of personality, with special emphasis upon projective techniques. Prerequisite: Psychology 443; consent of instructor. 1 unit.
445. **Behavior Modification.** A critical survey of issues, principles, practice, and research related to modifying human behavior. The course covers psychotherapeutic and somatic approaches; symptomatic relief and personality-restructuring, goal-orientations; individual, family, group, milieu, and preventive community intervention. Prerequisite: Psychology 444. Registration in Psychology 447 is strongly recommended. 1/2 unit.
446. **Laboratories in Clinical Psychology.** Intensive practice in techniques of clinical assessment and behavior modification with emphasis on recent innovations. Small sections of the course are formed according to the specialized interests of students and staff. Prerequisite: Psychology 445. 1/2 to 1 unit.
447. **Internship.** Supervised field experience in clinical psychology. Prerequisite: Consent of instructor. 0 to 4 units.
448. **Practicum in the Study of Individuals.** Substantive material on the study of lives, including; consistency and change in personality over time, relationship of mood and personality structure to behavior, techniques for the longitudinal study of individuals, and an evaluation of the case study method. Each student plans and conducts an experiment testing the application of concepts of personality and behavior dynamics to the study of an individual. Intended for students desiring supervised practicum experience in the assessment of normal behavior. Prerequisite: Psychology 441. 1/2 or 1 unit.
449. **Medicine in Clinical Psychology.** Introduction to areas of medicine and the organization of medical services as appropriate to the practice of clinical psychology. Medical facts, procedures, and viewpoints are presented to enhance the mutual contributions and collaborative efforts of medicine and clinical psychology. Prerequisite: Second-year graduate standing in clinical psychology or consent of instructor. 1/2 unit.
451. **Theory and Method in Social Psychology, I.** First of two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology. Participation and seminar presentations by social psychology program faculty. Each student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Admission as a graduate student to the social psychology program or consent of instructor. 1 unit.
452. **Theory and Method in Social Psychology, II.** Second of a two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology. Participation and seminar presentations by social psychology program faculty. Each student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Psychology 451. 1/2 unit.
453. **Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Sociology 456. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.
454. **Organizational Sciences, II.** Same as Business Administration 411, Political Science 461, and Sociology 457. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Psychology 453. 1 unit.
455. **Research Methods in Organizational Psychology.** Discussion and analysis of strategies,

methods, and techniques of organizational psychological research. Emphasis is given to methods for researching behavioral determinants within interdependent organizational roles. Prerequisite: Psychology 351 or 355 or 359, or consent of instructor. 1 unit.

- 456. Attitude Measurement and Behavioral Prediction.** Same as Communications 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction. Emphasis on the attitude concept and the validity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.
- 457. Theory and Research in Organizational Psychology.** Theory and research on the psychological processes involving the demands of organizations on the behavior of individuals. Emphasis is given to the processes of power, authority, influence, leadership, communications, decision making, and organizational change. Prerequisite: Psychology 455 or consent of instructor. 1 unit.
- 458. Advanced Problems in Attitude Research.** Intensive analyses of recent developments in attitude theory and research, with emphasis on the attitude-behavior relationship. Theories of attitude and attitude change are examined with respect to their utility in predicting and changing social behavior. Prerequisite: Psychology 352 or 456. 1 unit.
- 459. Advanced Problems in Research on Groups.** Intensive examination of current research and theory on structure, process, and performance of groups. Critical examination of recent research and theoretical literature, and development of research designs for related issues in the field. Prerequisite: Psychology 451 or consent of instructor. 1 unit.
- 460. Motivation and Personality Development in Children.** Theory, method, and research on the interaction of motivational personality, and learning processes and development in children, with emphasis on experimental studies and a social learning theory approach. Class projects involve some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
- 462. Human Abilities.** Analysis of individual differences in human abilities, including historical background, measurement methodology, and functional correlates of abilities. The use of ability measures in both experimental and applied research is considered. Prerequisite: Psychology 307 or equivalent. 1 unit.
- 463. Research Methods in Clinical Psychology and Personality.** The logical analysis of clinical inferences and their role in research; problems and methods in the investigation of the development, dynamics, and structure of personality; research in psychotherapy. Prerequisite: Psychology 306 and 403. 1/2 unit.
- 464. Advanced Problems in the Study of Individual Social Behavior.** An intensive examination of current research into one or more of the following areas: social perception and cognition; social motivation; social learning, environmental factors in social behavior. Critical examination of recent research and theoretical literature, and development of research designs for selected current issues. Prerequisite: Psychology 451; six units of psychology. 1 unit.
- 465. Learning in Children.** An examination of laboratory investigations of children's learning, with emphasis on developmental changes as related to current theories of learning and development. Class projects involve some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
- 466. Advanced Personality Theory.** An integration of concepts arising from quantitative, multivariate, experimental research on personality, requiring facility with precise models. Deals with measurement, personality and motivation structure, genetics, physiological determiners, models for family and cultural relations, and structured learning theory. Implications of personality theory in clinical, industrial, and educational psychology. Prerequisite: Psychology 306 and 307. 1 unit.
- 467. Personality Assessment.** Methods and theory in the quantitative assessment of personality; review of research findings and trends. Prerequisite: Psychology 307 or equivalent. 1 unit.
- 468. Contemporary Behavior Theory.** An introduction to modern attempts to formulate scientific theories of behavior, with special emphasis on theories concerning the learning

process, including the work of Hull, Tolman, and Guthrie. Prerequisite: Six units of graduate credit in psychology; consent of instructor. 1 unit.

469. **Cognitive Development.** An examination of laboratory investigations of cognitive development in children, with emphasis on current theories of cognition and language. Class projects involve some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
470. **Principles and Methods of Teaching Psychology.** Designed for graduate students in psychology. Among the major areas considered are: developing course objectives and content; developing and presenting teaching-learning situations; evaluating the attainment of course objectives; advising and counseling students; ethics in teaching; research problems on the teaching of psychology. Prerequisite: Second-year graduate standing in psychology or consent of instructor. 1/2 or 1 unit.
483. **Psychology of Speech and Hearing Disorders, I.** Same as Speech 483. A survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to speech disorders. Review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
484. **Psychology of Speech and Hearing Disorders, II.** Same as Speech 484. A survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders. Review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
485. **The Sampling of Human Populations and Social Organizations.** Same as Sociology and Business Administration 485. This course covers procedures for selecting samples from and estimating population parameters for human populations and social organizations. The types of sample designs treated include simple random samples, stratified and cluster samples, together with random number and systematic selection techniques. Emphasis is given to the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.
490. **Individual Research.** For graduate students who wish to conduct research on special problems not included in graduate theses. Prerequisite: Consent of instructor. 1/2 to 2 units.
492. **Psychology of Learning and Instruction.** Same as Educational Psychology 492. An advanced course in the nature and conditions of long-term cognitive learning and retention in classroom and similar situations. This course is intended for doctoral students with a special interest in research leading to the improvement of classroom teaching and learning, in psychological aspects of curriculum research, and in the cognitive aspects of military and industrial training. Prerequisite: Consent of instructor. 1 unit.
493. **Seminar.** Discussion of current topics in their historical setting, with special emphasis on research problems. Prerequisite: Six units of graduate credit in psychology; consent of instructor. 1/2 or 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Educational Psychology and Sociology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
495. **Theory of Measurement.** Same as Educational Psychology 495. Logical and mathematical principles underlying test design, construction, and validation, with particular emphasis on evaluating reliability of measurement, utility resulting from test-based decisions, and validity of descriptions of individuals. Prerequisite: Educational Psychology 496 or Psychology 307, or equivalent; Educational Psychology 392 or Psychology 390, or equivalent. 1 unit.
499. **Thesis Research.** 9 to 4 units.

RADIO AND TELEVISION

Head of Department: Professor P. WELCH

Department Office: 119 Gregory Hall

199. **Undergraduate Open Seminar.** 0 to 9 hours.
252. **Television Laboratory.** Designed to acquaint the student with basic television equipment and principles of studio operation. Emphasis is on the production of laboratory programs with students participating in the various jobs involved in studio production. Prerequisite: Consent of department. 3 hours.
261. **Principles of Radio and Television Broadcasting.** An introductory course in the history of American radio and television broadcasting, comparative broadcasting systems, organization and operation of stations and networks, social and legal responsibilities of radio and television, codes and practices of broadcasting, and an introduction to radio and television audience measurement and survey methods. Prerequisite: Junior standing. 2 hours.
263. **Radio and Television Announcing.** Intensive training in studio procedures and interpretation of radio and television copy, including news, feature scripts, continuity, and commercials. Prerequisite: Consent of department. 2 hours.
267. **Radio Production and Direction.** Study of the principles of planning, casting, rehearsing, and airing varied program types, with emphasis on advanced techniques of dramatic production. Prerequisite: Consent of department. 3 hours.
280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Speech 263, and Theatre 280. A study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in radio and television for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of department. 2 or 3 hours.
354. **Television Directing.** The theory and techniques of directing the television program; experience in directing laboratory production. Prerequisite: Radio and Television 252; consent of department. 3 hours or 1/2 unit.
355. **Television News.** News coverage, script preparation, use of visual materials, and presentation of news program. Attention is given to interviews, special events, and news fields of special interest. Prerequisite: Consent of department. 3 hours or 1/2 unit.
356. **Cinematography for Television.** The equipment and techniques used in the production of films for television, including camera operation, lighting, editing, sound recording, matching, etc. Materials cost approximately \$50.00. Prerequisite: Consent of department. 3 hours or 1/2 unit.
357. **Broadcast Continuity Writing.** A study of the fundamentals of radio and television continuity writing, including commercial copy, talks, interviews, and music and feature programs. Prerequisite: Consent of department. 3 hours or 1/2 unit.
360. **Educational Uses of Television and Radio.** Same as Educational Psychology 360. A study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; experimentation in new production and utilization techniques designed for educational uses. 3 hours or 1/2 unit.
362. **Radio and Television Station Management.** A study of the organization and administration of the radio and television staff and station; public relations, personnel management, and station operation; analysis of station and agency relationships and radio and television sales procedures; methods and media for program and station promotion; laws and regulations affecting management, financing, and labor relationships. Prerequisite: Radio and Television 261; senior standing; consent of department. 2 hours or 1/2 unit.

363. **Advanced Dramatic Writing.** Same as Speech 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Rhetoric or Speech 263 or Radio and Television or Theatre 280; consent of instructor. 3 hours, or 1/2 or 1 unit. May be repeated for a maximum of 6 hours or 2 units.
365. **Radio News.** News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services; and processing radio news-service copy. Prerequisite: Journalism 211; consent of department. 3 hours or 1/2 unit.
366. **Advanced Radio and Television Practices, I.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or 1/2 unit.
367. **Advanced Radio and Television Practices, II.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or 1/2 unit.
368. **Radio and Television Regulation.** Federal legislation, with emphasis on Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. Prerequisite: Senior standing; consent of department. 2 hours or 1/2 unit.
450. **Special Problems in Television.** Project work for advanced students in specific areas of television, including news, advertising, directing, writing, etc. Prerequisite: A television course in the area of specialization; consent of department. 1/2 to 3 units. A maximum of 3 units is permitted toward degree.
451. **Television Program Management and Production.** Problems in originating, planning, and producing television programs. Prerequisite: Course or experience in television directing and production; consent of department. 1 unit.
462. **Seminar in Radio and Television.** Same as Communications 462. A study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
463. **World Broadcasting.** Same as Communications 463. A study of the broadcast systems used by the nations of the world; alternative and "mixed" systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other countries; implications of such new developments as satellities; mass and non-mass uses. Prerequisite: Radio and Television 462 or consent of instructor. 1 unit.
490. **Special Topics in Radio and Television.** 1/2 or 1 unit. Prerequisite: Consent of department.
499. **Thesis Research.** 1 to 2 units. Prerequisite: Graduate standing in radio and television.

RECREATION AND PARK ADMINISTRATION

Head of Department: Professor A. V. SAPORA

Department Office: 104 Huff Gymnasium

100. **Leisure: Its Uses and Resources.** Philosophical foundations of leisure and recreation; history of the development of parks and man's organized efforts to meet his leisure needs; introduction to present patterns of organized recreation; professional preparation for the field; evaluation of student skills and experience. 4 hours.
110. **Theories and Methods of Leadership.** Prerequisite: Recreation 100 or consent of instructor. 3 hours.

140. **Principles of Camping.** Objectives, organization, techniques, counseling, activities, evaluation. 3 hours.
180. **Field Experience, I.** Directed field experience in public and private recreation agencies. Designed to give students majoring in recreation an introduction to working in actual field situations. Students work in University-approved agencies of their own choice three hours each week. Prerequisite: One year of work in the recreation curriculum or consent of instructor. 0 to 1 hour.
181. **Field Experience, II.** Directed field experience in public and private recreation agencies. Designed to give students majoring in recreation an introduction to working in actual field situations. Students work in University approved agencies of their own choice three hours each week. Prerequisite: One year of work in the recreation curriculum or consent of instructor. 0 or 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Observation Trip.** Visitation and inspection of recreation programs, services, and facilities in public and private agencies; estimated cost, \$22.00. Prerequisite: Major or minor in recreation. 0 credit.
210. **Theories and Methods of Supervision.** Concepts, principles, and objectives of supervision; the nature of the supervisory relationship; supervisory functions and processes; identification and application of methods and techniques; organizational and operational patterns of supervision in recreation and park settings. Prerequisite: Recreation 180 and 181, or consent of instructor. 3 hours.
215. **Recreation Program Development.** Theory and practice in recreation program development in the various recreation settings, including public, private, and commercial operations. Core programming and programming dictated by the needs of the field, setting, or clientele; program evaluation. Prerequisite: Recreation 100 and 200, or consent of instructor. 3 hours.
230. **Introduction to Therapeutic Recreation.** An introduction to concepts and principles of therapeutic recreation; types of illnesses and disabilities; settings; programming and services; role of the therapeutic recreator. Prerequisite: Recreation 100, 110, and 180, or consent of instructor. 3 hours.
240. **Introduction to Outdoor Education and Recreation.** Philosophy and principles; programs and methods used by various types of institutions; field experience. Prerequisite: Recreation 100 or consent of instructor. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, or related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 to 3 hours. May be repeated for a total of 4 or 6 hours credit.
260. **Honors Seminar.** Same as Health Education, Physical Education for Men, and Physical Education for Women 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.
272. **Organization of Aquatic Programs.** Same as Physical Education for Men and Physical Education for Women 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.
273. **Recreation in Rural Areas.** Same as Agricultural Economics 273. Growth and development of recreation in rural areas; leadership development; agencies; types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, \$5.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours.
274. **Urban Recreation.** Orientation to the urban and inner-city setting and to the role of recreation within this community; methods and techniques effective in out-reach programs; guest lecturers in related fields such as urban planning, social work, etc.; guest

speakers from local community; field trips and field experience; readings from several disciplines as relevant. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.

277. **Introduction to College Union Programs and Services.** The theory and practice of college union administration; history of college unions; study of the methods of organization, physical plant, personnel, business administration, programs, and public relations involved in college union operations. Prerequisite: Senior standing; open to recreation majors and students with experience in student union work or related activities, or consent of instructor. 3 hours.
280. **Pre-Practicum Seminar.** Seminar discussions to prepare students for summer field practicum; placement; work situation; agency-university relationships; supervision; evaluation. Prerequisite: Recreation 181; junior standing; consent of the supervisor of field training. 0 credit.
281. **Professional Field Practicum.** During the first and second semesters, students participate in leadership activities six hours each week on assignment in local and neighboring communities. During the summer session, students work in approved agencies within Illinois for eight weeks between the junior and senior years. Prerequisite: Recreation 280. 4 hours.
290. **Research in Recreation and Parks.** The place of research in recreation and parks; research design; data collection, processing, and analysis; use of completed research; development of an appreciation of and an ability to evaluate and utilize research rather than ability to conduct research. Prerequisite: Senior standing; consent of instructor. 3 hours.
310. **Introduction to Administration.** Organization of public and private agency programs, leadership, facilities, and services, and introduction to recreation administration. Prerequisite: Recreation 100; advanced undergraduate standing. 3 hours, or 1/2 or 1 unit.
315. **Play Theories and Their Implications.** Classical, recent, and modern theories of play; critical analysis of definitions, concepts, assumptions, extant research and research strategies; implications for programming and planning for play. Prerequisite: Recreation 110, 215, and junior standing, or consent of instructor. 2 to 4 hours, or 1/2 to 1 unit.
320. **Park Management.** An intensive study of the principles, practices, and problems involved in managing public park systems. Designed to provide a professional background including the history of parks, organization, planning, examination of facility design and layout, maintenance, finance, and operation of park systems. Prerequisite: Open to senior recreation majors, or consent of the instructor; the following recreation courses or equivalent must be completed: Landscape Architecture 226, Urban Planning 171, Political Science 305, Recreation 280 and 281. 3 hours, or 1/2 or 1 unit.
321. **Recreational Use of Public Lands.** A study of lands in the public domain and their historical, current, and potential use for outdoor recreation. It includes an analysis of land, woods, and water in the public domain; the demand for outdoor recreation; multiple use concept of natural resources; functions and policies of federal and state governments and their agencies; the economics of outdoor recreation; and the future of outdoor recreation in America. Prerequisite: Recreation 100, Economics 108, and Geography 214, or consent of instructor. 3 hours, or 1/2 or 1 unit.
330. **Principles of Therapeutic Recreation.** Concepts, principles, objectives, methods, and settings of recreation for the ill and handicapped. Prerequisite: Advanced undergraduate or graduate standing; Recreation 100, and 180 or 181, or consent of instructor. 3 hours, or 1/2 or 1 unit.
331. **Recreation Leadership for Special Groups.** Emphasis on leadership theory and methods as they apply to special groups in recreational settings. These groups include conduct disorder, mentally ill, mentally retarded, and physically disabled. Prerequisite: Recreation 110 and 230. 3 hours, or 1/2 to 1 unit.
349. **Analysis of Small Groups in Play and Sport.** Same as Physical Education 349. The methodology of small group research and analysis of the small group in play and sport. Culture, social structure, and personality structure in the group. Class and student

observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or 1/2 or 1 unit.

- 381. Management Internship.** Work-study experience in the management aspects of leisure service delivery systems. Students are assigned to agencies in their special fields of study and are closely supervised by University faculty. Prerequisites: Recreation 281 or graduate standing. 2 to 4 hours, or 1/2 to 1 unit.
- 401. Foundations of Recreation.** Basic philosophical, historical, and scientific foundations and developments in leisure and recreation; analysis of recreation values as related to other contemporary individual and community needs; functions and settings of organized recreation, special problem areas, and current issues. Prerequisite: Recreation 100 or equivalent. 1 unit.
- 402. Recreation Administration.** Designed to strengthen the graduate student's knowledge of the public administration of recreation programs and services provided by municipal, county, state, and national departments and agencies as related to the general well-being of individuals, families, and communities. Prerequisite: Basic courses in the organization of recreation, or equivalent. 1 unit.
- 403. Evaluation of Recreation Resources and Programs.** Methods and techniques of determining recreational needs, interests, and opportunities of individuals and communities through surveys, studies, and appraisals; evaluating and appraising community recreation programs and services; research in the field of recreation. Prerequisite: Recreation 100 or 310, or equivalent. 1 unit.
- 404. Outdoor Education and Recreation.** Philosophy, essential principles, methods, techniques, resources, administrative and program practices for outdoor education and recreation. Prerequisite: Recreation 140 or equivalent; one undergraduate course in any one of the following: biology, botany, geology, or zoology. 1 unit.
- 490. Seminar.** Student presentation of thesis studies, informal discussions, and critical analysis of problems; informal lectures by invited speakers. 0 credit.
- 493. Special Projects.** Independent research on special projects. Open only to students majoring in recreation. Prerequisite: Recreation 403 or equivalent. 1/2 to 2 units.
- 494. Special Topics in Recreation.** Lecture courses in topics of current interest are given under this number. Specific subject matter will be announced in the Time Table. Prerequisite: Will be determined for each course offered and will be indicated in the Time Table. 1/2 or 1 unit.
- 499. Thesis Research.** Preparation of thesis in recreation. 0 to 4 units.

RELIGIOUS STUDIES

Director of Program: Professor W. R. SCHOEDEL

Office: 4016c Foreign Languages Building

The interdepartmental Program in Religious Studies is sponsored by the College of Liberal Arts and Sciences and the Departments of Anthropology, Classics, History, Philosophy, and Sociology. Students wishing to study in this area should consult with their advisers and with the director of the program to develop individual programs suited to their needs and interests.

Minor: A minor in religious studies, designed to accompany a major in any department, requires at least twenty semester hours (including Religious Studies 201 and 202 and two courses in Asian religious traditions). With the approval of the Director of the Program, relevant courses other than those listed below may be used toward a minor.

- 108. Introduction to Biblical Hebrew.** Same as Hebrew 110. Stress on mastery of grammar, reading, writing, simple prose composition. Reading of simple Biblical prose. 4 hours.
- 109. Introduction to Biblical Hebrew.** Same as Hebrew 111. Syntax and reading of simple classics prose narrative. Prerequisite: Hebrew 110. 4 hours.

110. **World Religions.** Same as Philosophy 110. A survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours.
111. **Elementary Koine Greek.** Same as Greek 111. No credit toward graduation is given for Religious Studies 111 without Religious Studies 112. 4 hours.
112. **Elementary Koine Greek.** Same as Greek 112. Continuation of Greek or Religious Studies 111. Grammar and reading. Prerequisite: Religious Studies 111 or equivalent. 4 hours.
200. **Intermediate Koine Greek.** Same as Greek 200. Prerequisite: Religious Studies 112 or equivalent. 4 hours.
201. **Ancient Israel: History and Literature.** Same as Humanities 201. The major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion. The function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours.
202. **Earliest Christianity: The New Testament Period.** Same as Humanities 202. The ministry and teaching of Jesus within the historical context of ancient Judaism, and the development of the Christian church from its beginnings as a sect within ancient Judaism to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours.
203. **The Pentateuch.** Detailed study of the Pentateuch in English: Near Eastern background, literary forms and functions, heritage to Judaism and Christianity. Prerequisite: Religious Studies 201. 3 hours.
205. **Theology of the Covenant in the Hebrew Bible.** Form, structure, and meaning of the Covenant as theological expression of the relationship between God and Israel in the entire literature of the Hebrew Bible. Prerequisite: Religious Studies 201. 3 hours.
206. **The Parables of Jesus.** The parables in the teaching of Jesus, early Christianity, and the New Testament as expressions of Judaeo-Christian cultural, social, and religious life. Prerequisite: Religious Studies 202. 3 hours. •
208. **The Dead Sea Scrolls.** Same as Humanities 208. The literary works discovered in 1947 which were collected or written by a sect within Judaism near Wadi Qumran prior to the destruction of the Jerusalem Temple in the first century of our era. Their significance for understanding Judaism and Christianity. Prerequisite: Religious Studies 201 or 202. 3 hours.
210. **Biblical Prose.** Same as Hebrew 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Religious Studies 108 and 109. 4 hours.
211. **Biblical Poetry.** Same as Hebrew 211. Reading and discussion of the Book of Amos and of selections from the Psalms; exercises in prose composition. Prerequisite: Religious Studies 210. 4 hours.
229. **Sociology of Religion.** Same as Sociology 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Philosophy 230. A critical study of theories about the nature of religion. 3 hours.
290. **Independent Study.** Special topics not treated in regularly scheduled courses. Designed primarily for upperclassmen. Prerequisite: Evidence of adequate preparation for such study; consent of staff member supervising the work. 2 to 6 hours. May be repeated.
297. **Introduction to Hinduism.** Elements of Hindu thought and practice; selected topics presented in historical order and in the context of Indian cultural history (including the present). 3 hours.
304. **Medieval Civilization.** Same as History 304. Religious and intellectual. Prerequisite: One year of college history or political science. 3 hours, or 1/2 or 1 unit.

306. **The Age of the Protestant and Catholic Reformation, 1500–1648.** Same as History 306. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as History 307. Prerequisite: One year of college history. 3 hours, or 1/2 or 1 unit.
328. **Sociology of Asian Religions.** Same as Sociology 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa, focused on the problems of social change and development. Concentration is on the religious and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Religious Studies 229 or consent of instructor. 3 hours, or 1/2 or 1 unit.
340. **The Formation of Christian Thought.** A study of major developments in early Christian thought (first four centuries) through discussion of primary texts in translation. Prerequisite: Religious Studies 201 and 202, or consent of instructor. 3 hours, or 3/4 or 1 unit.
350. **Problems in Religious Thought: History, Historicity, and Belief.** Analysis of the New Testament gospel narratives, selected apocryphal gospels, debates over the historical integrity of gospel materials, production of lives of Jesus, the effort to delineate the mythological dimensions of the gospel narratives, and contemporary attempts to correlate thought. Prerequisite: One course in religious studies or consent of instructor. 3 hours, or 3/4 or 1 unit.
360. **Patristic Latin.** Same as Latin 360. Literary and historical texts in prose and poetry from Tertullian to Jerome and Augustine. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or 3/4 or 1 unit.
362. **Philosophy of Religion.** Same as Philosophy 324. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their modern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
363. **Religion in Anthropological Perspective.** Same as Anthropology 363. An introduction to the study of magical and religious beliefs and practices in tribal and peasant societies. Considers theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socio-religious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
368. **Indian Philosophy.** Same as Philosophy 369. A survey of Indian philosophy emphasizing readings in the fundamental texts of Indian thought, and developing basic familiarity with the wide range of Indian philosophies and theologies. Prerequisite: Either a previous course in philosophy, or Religious Studies 297, or any of History 387, 393, 397, 398, 399. 3 hours, or 3/4 or 1 unit.
369. **Contemporary Religious Thought.** Same as Philosophy 363. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "Neoorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or 3/4 or 1 unit.
371. **The Gospels.** Same as Greek 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or 3/4 or 1 unit.
387. **History of Indian Buddhism.** The history of Buddhism in India from the Buddha to the Tantra, with emphasis on religious thought and practice. 3 hours, or 3/4 or 1 unit.
397. **History and Thought of Japanese Buddhism.** Same as History 397. The Japanese response to Buddhism and its influence on Japanese life and culture. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 to 1 unit.
399. **History and Thought of Chinese Buddhism.** Same as History 399. The interaction of Buddhism with Chinese thought and institutions from its introduction to the present. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 or 1 unit.

Rhetoric

(See English)

Romance Linguistics

(See Spanish, Italian, and Portuguese)

Rumanian

(See Spanish, Italian, and Portuguese)

Rural Sociology

(See Agricultural Economics)

Russian

(See Slavic Languages and Literatures)

RUSSIAN LANGUAGE AND AREA STUDIES

Director of Russian and East European Center: Professor R. T. FISHER, JR.

Center Office: Room 150, 1208 West California Avenue, Urbana

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Students who elect Russian language and area studies as a major must:

1. Complete the prescribed and general education sequences required in the sciences and letters curriculum.

2. Complete at least twenty semester hours of Russian language courses, in addition to Russian 101 and 102, or demonstrate equivalent proficiency.

3. Complete a major consisting of at least twenty semester hours distributed among at least four departments and chosen from the following courses: Anthropology 381, 382; Economics 357; Geography 353; History 219, 320, 321, 325, 327, 328; Political Science 335, 383; Russian 114, 115, 116, 199, 217, 301, 302, 317, 321, 322, 323, 324, 325, 335, 337; Sociology 350; Ukrainian 396, 398. Courses used for major or minor credit outside the program of Russian language and area studies may not count as part of this twenty hours.

4. Complete a minor of twenty hours, excluding courses open to freshman, in one or two departments. If two are chosen at least eight hours must be taken in each. Courses in Russian language may, with the approval of the Center director, constitute all or part of this minor.

Minor: A minor in Russian language and area studies, designed to accompany a major in any department, requires at least twenty semester hours distributed among at least three departments and chosen from the following courses: Anthropology 381, 382; Economics, 357; Geography 353; History 219, 320, 321, 325, 327, 328; Political Science 335, 383; Russian 114, 115, 116, 199, 217, 301, 302, 317, 321, 322, 323, 324, 325, 335, 337; Sociology 350; Ukrainian 396, 398. It also requires a knowledge of Russian equivalent at least to that normally attained after Russian 101 and 102.

The adviser for the above programs is Professor Ralph T. Fisher, Jr., Director of the Russian and East European Center, 1208 West California Avenue, Urbana.

STUDENTS IN OTHER COLLEGES

Students in other colleges and schools of the University who desire a knowledge of the Russian area are invited to consult, either directly or through their advisers, with the director of the Russian and East European Center in order to develop programs suited to their individual needs. Such programs may in some cases be adopted as a special minor.

Safety Education

(See Health and Safety Education)

Sanskrit

(See Asian Studies)

Scandinavian

(See Germanic Languages and Literatures)

SECONDARY AND CONTINUING EDUCATION

Department Office: 395 Education Building

101. **Introduction to the Teaching of Secondary School Subjects.** An analysis of problems and trends in the teaching of high school subjects. Special sections are provided in the usual high school fields. Standard and new programs are assessed. Research and empirical evidence are explored as they relate to effective teaching of the special subjects. 2 hours.
106. **Introduction to Computers for Teachers.** Same as Computer Science 106. An introduction to the principles of computer operation and programming, and their applications to education. Students use computers to solve problems. Credit may be received for only one of the following: Computer Science 101, 103, 105, 106, 107, 121. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
240. **Principles of Secondary Education.** Designed to provide each specialized educational worker with a common orientation to the major responsibilities of the public school as a unit and his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Secondary and Continuing Education 101; Psychology 100. 2 hours.
241. **Technic of Teaching in the Secondary School.** Methods of teaching specific subject matter fields in the secondary school. Special sections are provided in the usual high school subjects. Prerequisite: History and Philosophy of Education 201; Secondary and Continuing Education 240; registration in Educational Practice 242; consent of instructor. This course meets only during the first six and the last four weeks of the semester. 3 to 5 hours.
247. **Teaching of Speech.** Same as Speech 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.
249. **Independent Study.** Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours. (Section B, 3 hours).
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
336. **Fundamentals of Reading Techniques.** Same as Elementary Education 336. Basic principles, techniques, and materials for the developmental reading program. Emphasis is placed on methods and materials which provide for differentiated instruction. Prerequisite: Junior standing; registration in a teacher education curriculum. 3 hours, or 1/2 or 1 unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Elementary Education 338. Developmental reading programs beyond the primary grades. Factors related to

- reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Educational Psychology 211; junior standing. 3 hours, or 1/2 or 1 unit.
354. **Audio-Visual Communication.** Same as Elementary Education and Library Science 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or 1/2 or 1 unit.
356. **The Computer and Mathematics Education.** Surveys the role of the computer as an educational tool with an emphasis on applications for teaching pre-college mathematics. Analysis of computational problems and development of algorithms for their solution; iteration, nonlinear interpolation, and Monte Carlo methods; computer-assisted instruction; individually prescribed instruction; modular scheduling; information retrieval; library programs; natural language analysis. Prerequisite: Computer Science 101, 400, or consent of instructor. 4 hours or 1 unit.
357. **Computer-Assisted Instruction.** Same as Computer Science 357. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons. Among the topics treated are instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Computer Science 107 or equivalent, or consent of instructor. 4 hours or 1 unit.
439. **Fundamentals of Curriculum Development.** Designed to explore and clarify the several theoretical bases offered in educational literature for each of the major aspects of curriculum planning, to indicate the forms implementation of these theories have assumed in practice, to reduce these theoretical and practical differences to fundamental issues, to encourage critical evaluation of both the theories and practices from the standpoint of logical and empirical evidence, and to project, on the basis of such analysis, needed research, present best practice, and ultimately desirable programs. 1 unit.
441. **Linguistic and Logical Analysis of Teaching.** An analysis of teaching from the standpoint of semantic and logical factors. Topics such as theories of meaning, definition, explanation, and justification as employed by a teacher are discussed. 1 unit.
448. **Continuing Education.** Same as Vocational and Technical Education 448. Development, status, and prospects of continuing education for adults. Institutions, agencies, and programs; public policy and policy-making for continuing education; organization, administration, finance, and promotion; recruiting, training, and supervising staff; planning programs and courses; the literature of continuing education. Systematic study of individual problems supplements class work. 1/2 or 1 unit.
449. **Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
456. **Problems and Trends in Specialized Fields of Secondary Education.** This course introduces the student to significant problems, points of view, and trends in the field concerned. Significant research relating to organization, content, and techniques in the field in question is explored. Students are encouraged to make special studies in approved areas. Sections are usually offered in the following fields: (a) language and composition, (b) literature, (c) foreign languages, (d) mathematics, (e) science, (f) social science, (g) physical education, (h) music, (i) art. 1 unit.
459. **Workshop in Curriculum Development.** Curriculum development projects in specialized fields of secondary and continuing education. 1/2 to 2 units.
490. **Seminar for Advanced Students of Education.** Open only to persons who have been admitted for doctoral study in secondary and continuing education. Sections are usually

offered in the following fields: (a) English, (b) foreign languages, (c) mathematics, (d) science (e) social studies, and (f) music. 0 to 1 unit; may be repeated for a maximum of 2 units.

- 491. Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
- 499. Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

Serbo-Croatian

(See Slavic Languages and Literatures)

SLAVIC LANGUAGES AND LITERATURES

(Including Czech, Polish, Russian, Serbo-Croatian, Slavic, and Ukrainian)

Head of Department: Professor C. L. DAWSON

Department Office: 3092 Foreign Languages Building

Czech

- 383. The Structure of Modern Czech.** Analysis of the sound system and grammar of the contemporary Czech language with some reference to its historical development. Prerequisite: A knowledge of another Slavic language, preferably Russian, or consent of department. 3 hours or 3/4 unit.
- 384. Readings in Czech Literature.** Representative works of modern Czech literature and their historical and cultural background. Prerequisite: Czech 383 or consent of department. 3 hours or 3/4 unit.

Polish

- 385. The Structure of Modern Polish.** Analysis of the sound system and grammar of the contemporary Polish language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or 3/4 unit.
- 386. Readings in Polish Literature.** Analysis of selected literary texts. Prerequisite: Polish 385 or consent of department. 3 hours or 3/4 unit.

Russian

REQUIREMENTS FOR I.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty-four hours of course work beyond Russian 115, at least nine hours of which must be in courses at the 300 level. Majors are required to take a minimum of three literature courses which are taught in Russian and one survey course taught in English.

Minors: Twenty hours in not more than two subjects from the following list, with at least eight hours in each subject if two are chosen: Arabic, education, Chinese, English (excluding Rhetoric 101 and 102), French, German, Greek, Hindi, history, Italian, Japanese, Latin, library science, linguistics, philosophy, political science, Portuguese, Spanish, or any minor Slavic language. The first semester of course work in any foreign language may not be counted

toward a minor in that subject. The curriculum in Russian language and area studies comprising courses outside the Department of Slavic Languages and Literatures may be accepted as a sole minor.

Departmental Distinction: Majors and minors in the Department of Slavic Languages and Literatures who have a University grade-point average of 4.0 and whose grade-point average in the Department of Slavic Languages and Literatures courses is 4.3 or higher, should enroll in Russian 291 and/or 292, Senior Thesis and Honors, for a total of at least two hours. Students may graduate with Departmental Distinction if the prescribed honors work is successfully completed. For Distinction, students must have a grade-point average of at least 4.3 in department courses and write an acceptable paper or pass an examination based on special readings; for High Distinction, students must have a grade-point average of at least 4.5 in department courses and write a thesis of good quality or pass an examination based on assigned readings; for Highest Distinction, students must have a grade-point average of at least 4.7 in department courses and write a thesis of superior quality.

Majors and minors in the department are urged to consult the departmental honors adviser during their junior year for information pertaining to graduation with Departmental Distinction.

Note: Courses taught in Russian are 211, 212, 213, 214, 215, 216, 217, 301, 302, 303, 304, 313, 314, 321, 322, 323, 324, 325, 415, 419, 420, 422, and 424.

101. **First-Year Russian.** Oral-aural practice, elements of grammar, reading, writing. For students who have no credit in Russian. No credit toward graduation is given for Russian 101 without Russian 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **First-Year Russian.** Continuation of Russian 101. Oral-aural practice, elements of grammar, reading, writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 101. 4 hours.
103. **Second-Year Russian.** Oral-aural practice, systematic functional grammar, reading, writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 102 or equivalent. 4 hours.
104. **Grammar Review and Conversation.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures and drills and homework sheets. Special attention is paid to improving listening and speaking skills through class discussions and oral reports in Russian. Prerequisite: Russian 103. 4 hours.
105. **Grammar Review and Readings on Russian Culture.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures and drills and homework work sheets, as well as readings on various topics aimed at increasing the student's vocabulary and broadening his cultural awareness of the Russian people. Prerequisite: Russian 103. 4 hours.
106. **Grammar Review and Readings in Russian Literature.** This course is identical to Russian 105, except that the readings are selected from Russian artistic literature. Prerequisite: Russian 103. 4 hours.
111. **Intensive First-Year Russian.** Oral-aural practice, elements of grammar, reading, writing. This course is equivalent to Russian 101 and 102. For students who have no credit in Russian. All students in this course are required to register for two hours of work weekly in the language laboratory. 8 hours.
112. **Intensive Second-Year Russian.** Oral-aural practice, elements of grammar, reading, writing. This course is equivalent to Russian 103 and 104. All students in this course are required to register for two hours of work weekly in the language laboratory. Prerequisite: Russian 111 or 102. 8 hours.
114. **Russian Civilization.** Same as Humanities 114. A survey of Russian civilization and culture with special emphasis on areas other than literature: the people, national and social institutions, and religion, and the arts (architecture, sculpture, painting, music, theatre, ballet). No knowledge of Russian required. 4 hours.
115. **Russian Literature in Translation, I.** Critical survey of major works in Russian litera-

ture from the Kievan period to the early Tolstoy, with emphasis on the first half of the nineteenth century. In English translation. 3 hours.

116. **Russian Literature in Translation, II.** Critical survey of major works in Russian literature from the middle years of the nineteenth century to the Revolution, with emphasis upon Dostoevsky, the mature Tolstoy, Chekhov, and others. In English translation. 3 hours.
121. **Beginning Reading Course, I.** Russian basic grammar and vocabulary for recognition purposes; prepares students to read Russian for meaning and translate into English. This course, taken in sequence with Russian 122, 123, 124, meets the same requirements, and can be taken in place of Russian 101, 102, 103, 104. 4 hours.
122. **Beginning Reading Course, II.** Practice in reading and translating Russian texts of a general and specialized nature. Emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 121. 4 hours.
123. **Intermediate Reading Course, I.** Practice in reading and translating Russian texts of a general and specialized nature. Emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 122. 4 hours.
124. **Intermediate Reading Course, II.** Continuation of Russian 123. Prerequisite: Russian 123. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
211. **Oral Russian, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 104 or consent of instructor. 2 hours.
212. **Oral Russian, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 211 or consent of instructor. 2 hours.
213. **Russian Composition, I.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 104 or consent of instructor. 2 hours.
214. **Russian Composition, II.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 213 or consent of instructor. 2 hours.
215. **Introduction to Russian Literature, I.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Two years of college Russian or consent of instructor. 3 hours.
216. **Introduction to Russian Literature, II.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Russian 215 or consent of instructor. 3 hours.
217. **Introduction to Contemporary Russian Literature.** Reading and critical analysis of selected readings from post-thaw (1956) Russian literature. Prerequisite: Russian 215. 3 hours.
280. **Teachers Course.** An introduction to the problems of the teaching of Russian and a study of textbooks. Prerequisite: Three years of college Russian or equivalent. 2 hours.
291. **Senior Thesis and Honors.** Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours.
292. **Senior Thesis and Honors.** Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours.
301. **Russian Prose Fiction, I.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature with emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 216 or equivalent. 3 hours or 3/4 unit.
302. **Russian Prose Fiction, II.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature with emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 301. 3 hours or 3/4 unit.
303. **Advanced Reading and Conversation, I.** Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Three years of college-level Russian. 2 hours or 1/2 unit.
304. **Advanced Reading and Conversation, II.** Practice in conversation with a native speak-

- er, based on reading materials from Russian literature and culture. Prerequisite: Russian 303 or equivalent. 2 hours or 1/2 unit.
307. **Structure of Russian.** The morphology, syntax, and lexicon of modern Russian, contrasted with English, with attention to problems of teaching. Prerequisite: Russian 214 or consent of instructor. 3 hours or 3/4 unit.
308. **Russian Phonetics and Pronunciation.** Study of the Russian sound system. Training in the improvement of pronunciation and intonation. Prerequisite: Russian 212 or consent of instructor. 3 hours or 3/4 unit.
313. **Advanced Composition and Usage, I.** Practice in advanced composition and study of advanced problems of grammatical structure with emphasis on morphological categories in Russian grammar. Prerequisite: Three years of college Russian including Russian 214, or consent of instructor. 3 hours or 3/4 unit.
314. **Advanced Composition and Usage, II.** Further practice in advanced composition and study of advanced problems of grammatical structure with emphasis on syntax, usage, and style. Prerequisite: Russian 313 or consent of department. 3 hours or 3/4 unit.
315. **Nineteenth-Century Literature in Translation.** Same as Humanities 315. A study of major Russian writers from Pushkin through Chekhov. No knowledge of Russian is required. 3 hours or 1 unit.
317. **Twentieth-Century Literature in Translation.** Same as Humanities 317. A study of major Russian writers from 1900 to the present. No knowledge of Russian is required. 3 hours or 1 unit.
321. **Russian Literature from 1810 to 1845.** Representative works of the period, with emphasis on Pushkin, Lermontov, and Gogol. Prerequisite: Russian 301 or consent of instructor. 3 hours or 3/4 unit.
322. **Dostoevsky and Tolstoy.** Representative works in their historical and cultural contexts. Prerequisite: Russian 301 or consent of instructor. 3 hours or 3/4 unit.
323. **Russian Literature from 1845 to 1880.** Representative works of the period, with emphasis on Turgenev and Goncharov. Prerequisite: Russian 301 or consent of instructor. 3 hours or 3/4 unit.
324. **Russian Literature from 1880 to 1917.** Representative works of the period, with emphasis on Chekhov, Gorky, and Blok. Prerequisite: Russian 301 or consent of instructor. 3 hours or 3/4 unit.
325. **Soviet Russian Literature.** Representative works of Russian literature since 1917; Mayakovsky, Leonov, Sholokhov, and others; historical and cultural backgrounds. Prerequisite: Russian 301 or consent of instructor. 3 hours or 3/4 unit.
335. **Russian Drama.** A historical survey of Russian dramatists and their works, from the origins in folk and liturgical playlets, through classicism, Gogol, Ostrovsky, Chekhov, and Stansilavsky, to Meierhold and the Soviet drama. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.
337. **Russian Poetry.** A study of significant Russian poets and their works from Zhukovsky through the twentieth century. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.
400. **Beginning Russian for Graduate Students.** Basic grammar and vocabulary, introduction to the reading of Russian texts in the sciences and the humanities. Designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. 4 semester hours. No graduate credit.
401. **Readings in Russian for Graduate Students.** Reading and translation of general and individually specialized materials, to increase speed, accuracy, and vocabulary. Designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. Prerequisite: Russian 400 or equivalent. 4 semester hours. No graduate credit.
406. **Russian Morphology.** A survey of the various parts of speech of modern standard literary Russian with special emphasis on the nominal and verbal systems. 1 unit.
407. **Russian Syntax.** A survey of historical and contemporary Russian syntax. Prerequisite: Consent of instructor or head of department. 1 unit.

408. **Russian Phonology.** Same as Linguistics 408. The sound pattern of Russian in its synchronic and diachronic aspects. Prerequisite: Consent of instructor. 1 unit.
410. **Old Russian Literature.** Reading and analysis of texts with historical and literary commentary. Prerequisite: Slavic 405 or Russian 417. 1 unit.
412. **Literature of the Eighteenth Century.** Reading of texts. Historical and literary background of the period. 1 unit.
414. **Pushkin.** The age of Pushkin; Pushkin's works in historical and comparative perspective; textual criticism, linguistic and structural analysis, intellectual interpretation, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
415. **Dostoevsky.** Dostoevsky: historical background, textual analysis, structure, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
416. **Studies in Russian Criticism.** Prerequisite: Consent of instructor or head of department. 1 unit.
417. **History of the Russian Language.** Historical grammar, origin, and development of the literary language. Prerequisite: Slavic 405. 1 unit.
419. **Tolstoy.** Tolstoy: historical background, textual analysis, structure, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
420. **Chekhov.** Chekhov: historical background, textual criticism, structural analysis, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
421. **Seminar in the Russian Novel.** Dostoevsky, Tolstoy, nineteenth-century novel, twentieth-century novel. Prerequisite: Consent of instructor or head of department. 1 unit. May be repeated for a total of 3 units.
422. **Russian Literature in Exile.** Bunin, Merezhkovsky, Kuprin, Zaitsev, Remizov, Teffi, Aldanov, Shmelev, Z. Hippus, V. Ivanov, Khodasevich, Tsvetaeva, Varshavsky, Odoevtseva, G. Ivanov, Adamovich—prose writers, poets, and critics. 1 unit.
423. **Seminar in Russian Poetry.** Pushkin, narrative verse, lyric verse, symbolism. Prerequisite: Russian 337 or consent of department. 1 unit. May be repeated for a total of 3 units.
424. **Gogol.** Historical background, textual criticism, structural analysis, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
425. **Seminar in Russian Drama.** Intensive analysis and discussion of specific genres, periods, and dramatists in the light of dramatic theories. The subject of the course varies each year. Prerequisite: Russian 335 or consent of department. 1 unit. May be repeated for a total of 3 units.
463. **College Teaching of Foreign Languages.** Same as French, German, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, literary appreciation; the use of technology; recent experimentation. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, German, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, language as an aspect of culture and societal relations. Prerequisite: Russian 463 or consent of instructor.

Serbo-Croatian

392. **Structure of Modern Serbo-Croatian.** Analysis of the sound system and grammar of the contemporary Serbo-Croatian language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or 3/4 unit.

393. **Reading in Serbo-Croatian Literature.** Reading, analysis, and discussion of selected excerpts from Serbo-Croatian literature, scientific prose, and current press. Prerequisite: Serbo-Croatian 392 or consent of department. 3 hours or 3/4 unit.

Slavic

319. **Russian and East European Cinema.** Same as Communications, Humanities, and Speech 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or 3/4 unit.
380. **Introduction to Slavic Linguistics.** Same as Linguistics 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or 3/4 unit.
382. **Language Laboratory Techniques.** Same as French, German, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity. Instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or 1/2 unit.
394. **Introduction to Folklore: History, Theory, Methods.** Same as Comparative Literature, English, and German 394, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, and analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or 3/4 unit.
405. **Old Church Slavonic.** Analysis of grammar, reading of texts, discussion of development of the Slavic languages. Prerequisite: Slavic 380. 1 unit.
431. **Comparative Slavic Literature.** Same as Comparative Literature 431. A survey of Slavic literatures, especially Czech, Polish, and Yugoslav and their connection with Russian and Western traditions. Prerequisite: Reading knowledge of Russian or one other Slavic language, or consent of instructor. 1 unit.
460. **Comparative Slavic Linguistics.** A comparative analysis of the structure of contemporary Slavic languages in the light of their common Slavic origin. Prerequisite: Slavic 380. 1 unit.
485. **The Structure of West Slavic Languages.** Linguistic survey of the West Slavic languages: Polish, Czech, Slovak, Lusatian, and Kashubian. Focus on one of the major West Slavic languages (Czech or Polish) as compared with the other West Slavic languages and languages of the East and South groups. Prerequisite: Slavic 380. 1 unit.
491. **Individual Topics.** Prerequisite: Graduate standing with a major or minor in Russian. 1/4 to 2 units.
492. **The Structure of South Slavic Languages.** Linguistic survey of the South Slavic languages: Serbo-Croatian, Bulgarian, Slovenian, and Macedonian. Focus on Serbo-Croatian as compared with the other South Slavic languages and the languages of the East and West Slavic groups. Prerequisite: Slavic 380. 1 unit.
499. **Thesis Research.** 0 to 4 units.

Ukrainian

396. **The Structure of Ukrainian.** Ukrainian phonology, morphology, and syntax, presented against Russian as a background and basis for comparison of these two East Slavic languages. Prerequisite: Russian 104 or equivalent. 3 hours or 3/4 unit.
398. **Readings in Ukrainian Literature.** Representative works of Ukrainian literature and their historical and cultural background. Prerequisite: Ukrainian 396 or consent of instructor. 3 hours or 3/4 unit.

SOCIAL SCIENCES

The Division of Social Sciences sponsors the following programs: (1) An undergraduate minor in Latin-American studies; (2) a graduate minor in Latin-American studies; (3) an undergraduate major and minor in Russian area studies; (4) a graduate minor in Russian area studies; (5) a graduate program leading to the degree of Master of Arts in the Social Sciences; (6) a graduate program leading to the degree of Master of Arts in the Teaching of Social Studies; (7) a graduate major and minor in linguistics; (8) an undergraduate minor in Asian studies; (9) a graduate minor in Asian studies.

The Division of Social Sciences calls to the attention of students the offerings in the general field of international affairs, and of non-Western areas found at the University. The Division recommends that the student interested in international affairs and non-Western areas consult with the adviser in his major department or with the Center for Asian Studies, Center for Latin-American Studies, or the Russian and East European Center, or the chairman of the African Studies Committee, concerning the possibility of taking courses in these subjects either as part of a minor or split minor, or as electives.

Students interested in preparing for entrance examinations for the foreign service of the United States are urged to consult with the government placement consultant of the University Coordinating Placement Office, who may be seen at the Institute of Government and Public Affairs, 1201 West Nevada Street, Urbana.

199. Undergraduate Open Seminar. 0 to 9 hours.

SOCIAL WORK

Director of Jane Addams Graduate School of Social Work: Professor M. P. HALE
School Office: 1207 West Oregon Street, Urbana

SOCIAL WORK AS A MINOR

Courses in social work may be counted toward a minor in the Departments of Anthropology, Economics, Political Science, Psychology, and Sociology.

COOPERATIVE INTERDEPARTMENTAL MAJOR AND MINOR IN SOCIAL WELFARE

The program is a joint plan of the College of Liberal Arts and Sciences and the Jane Addams Graduate School of Social Work. The undergraduate curriculum presents a broad interdisciplinary basis for the field of social welfare. See the College of Liberal Arts and Sciences Cooperative Interdepartmental Majors and Minors section in the Undergraduate Study catalog.

199. Undergraduate Open Seminar. 0 to 9 hours.

290. Honors Seminar. A series of lectures, student presentations, and discussions on selected topics in social welfare. Prerequisite: Completion of twelve semester hours in social welfare courses; senior standing; 4.0 grade-point average in courses included in social welfare; consent of instructor. 2 to 4 hours. May be repeated to a total of 4 semester hours.

300. Methods of Social Work Intervention. Examination of the methods of social work intervention (casework, group work, and community organization) utilized in various social work agencies and social welfare settings. Understanding of the values, knowledge, principles, and processes of social work practice is emphasized. Prerequisite: Credit or registration in Social Work 226. 3 hours, or 1/2 to 1 unit.

310. Social Welfare Policy and Services, I. Critical study of the income maintenance system in the United States as a response to the problems of inequality of opportunity and income, poverty, and income security. Alternative approaches are considered with dis-

- cussion of the social worker's role in the system. Prerequisite: Admission to social welfare major or minor, or graduate standing. 3 hours or 1 unit.
311. **Social Welfare Policy and Services, II.** Critical evaluation of social policy and services in three major problem areas—public health, aged, and housing with attention given to the process of social policy analysis and to strategies for intervention to achieve redirection in use of resources to deal more effectively with the problems. Prerequisite: Credit or registration in Social Work 310. 3 hours or 1 unit.
316. **Social Services for Children.** Child welfare practice in relation to the state's responsibility for guardianship, the juvenile court, employment, and regulation of child care facilities. An examination of services which support, supplement, or substitute for parental care of children; consideration of trends and issues in child welfare planning. Prerequisite: Credit or registration in Social Work 300, or consent of instructor. 3 hours, or 1/2 to 1 unit.
318. **Special Problems.** A small group seminar for independent study of a topic or topics of special interest to the field of social welfare. Emphasis is on examination and discussion of significant and current social welfare issues and problems. Prerequisite: Credit or registration in Social Work 300; consent of instructor. 3 hours, or 1/2 to 1 unit.
326. **Afro-American Life and Culture.** An examination and review of selected aspects of Afro-American life and culture. African heritage, American experience, concept of Negritude, and their implications for social workers. Prerequisite: Admission to social welfare major or graduate standing. 3 hours or 1 unit.
327. **Research Methods in Social Work Practice.** Objectives of research pertaining to social work practice, design of experiments, measurement and methods of collecting data, design of questionnaires and schedules, methods of data analysis including statistical hypothesis testing and applications of inferential techniques, interpretation of results, preparation of reports. Prerequisite: An introductory course in statistics and admission to social welfare major, or graduate standing. 3 hours or 1 unit.
333. **Introduction to Social Group Work.** Background information regarding the development of social group work. Attention is given to the utilization of the group work method in contemporary social work practice, practice principles, and group theory. Material presented through lecture-discussion and by participation in small groups formed from the class membership. Prerequisite: Junior standing with introductory courses in sociology, psychology, and the social sciences. 3 hours or 1 unit.
351. **Human Growth and Behavior, I.** The major forces influencing the growth and behavior of the individual from birth through adulthood; sociocultural, familial, physical, emotional, and intellectual factors as they enhance or retard social functioning; the nature and dynamics of social process as related to growth and behavior; the relevance of this content to social work practice. Prerequisite: Six hours or psychology and/or sociology; admission to social welfare major or graduate standing. 3 hours or 1 unit.
420. **Comparative Approaches in Community Organization Practice.** Concepts and theories, principles and methods characterizing identifiable approaches used in community organization practice at neighborhood, community, state, and other levels. Prerequisite: Credit or registration in Social Work 421, or consent of instructor. 1/2 to 2 units.
422. **A Comparative Analysis of Approaches in Casework.** A systematic and critical examination of selected approaches, their conceptualizations, procedures, and techniques in casework theory and practice. The employment of a framework for the analysis and assessment for the various approaches. The selected approaches: psycho-social therapy; crisis intervention; family treatment; advocacy; behavior therapy; and others. Study of research related to process and outcome. Identification of practice issues. Prerequisite: Consent of instructor. 1/2 to 1 1/2 units.
423. **Comparative Approaches to Social Group Work Practice.** Study of practice theory in social group work through a comparative study of various identifiable practice approaches. Prerequisite: Social Work 425 or consent of instructor. 1/2 to 1 1/2 units.
425. **Group Process and Method.** Small group theory and the group process; the use of group process and methods in social work practice. 1/2 to 1 unit.

- 426. Social Planning and Administration.** Principles, concepts, and methods of planning and administration of social services; emphasis on leadership, policy and decision making, and program organization. 1/2 to 1 unit.
- 428. Seminar on a Comparative Analysis of Selected Models of Family Therapy.** Critical examination of the principles, issues, and practice of family therapy. Application of concepts to observation of actual family therapy conducted by students and/or the instructor. The process of developing a model for practice. 1/2 to 1 1/2 units.
- 429. Seminar in Methods of Intervention with Low-Income Families.** Analysis of distinguishing characteristics and social problems of low-income populations; critical review of issues regarding social work interventive methods utilized in the past and at present. Emphasis is placed on analysis, construction, and evaluation of significant practice principles with a view toward innovation. Prerequisite: Social Work 422 or equivalent. 1/2 to 1 1/2 units.
- 431. Practice Seminar, I.** Critical examination of the application of knowledge to social work practice; emphasis on reciprocal relationships between personal problems and needs, social environment, agency services, and helping methods; consideration of new trends in practice and empirical knowledge. Prerequisite: Consent of instructor. 1 unit.
- 432. Practice Seminar, II.** Critical examination of the application of knowledge to social work practice; emphasis on relationships between personal problems, social problems, planning processes, and agency purposes and functions, consideration of trends in social policy and empirical knowledge. Prerequisite: Consent of instructor. 1 unit.
- 435. Seminar in Staff Development.** Examination of various types of staff development approaches used in social welfare. Analysis of selected problems occurring in planning and carrying out a staff development program. Issues in program planning and in budgeting for staff development will be considered. Prerequisite: Social Work 422; registration in any one of the following: Social Work 420, 423, or 429. 1/2 to 1 unit.
- 452. Human Growth and Behavior, II.** Inter-relationship of physical, emotional, and social aspects of selected diseases, and implications for the patient, family, and community; psychopathology, including neuroses, psychoses, character disorders, psychosomatic dysfunction, organic conditions, and mental retardation; diagnosis and treatment methods, including psychotherapy, somatic and drug therapies, and social work. Prerequisite: Social Work 351. 1/2 to 1 1/2 units.
- 454. Afro-American Issues Seminar.** A critical analysis of social, political, and economic issues as they relate to the Black community and the response of the community to these issues. Prerequisite: Social Work 326. 3 hours or 1 unit.
- 461. Special Studies in Social Work, I.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. 1/2 to 2 units.
- 462. Special Studies in Social Work, II.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. 1/2 to 2 units.
- 467. Field Instruction, I.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Consent of instructor. 1/2 to 1 unit.
- 468. Field Instruction, II.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Consent of instructor. 1 to 2 units.
- 469. Field Instruction, III.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Social Work 422, 466, 467, and 468. 1 to 2 units.
- 484. National Social Welfare Policy, I.** Analysis of the impact of changing economic and political doctrines, of ideological differences and struggle, and of major events such as

wars, depressions, urban strife, the civil rights revolution, sustained poverty, and cybernetics on national social policies and the operation of social welfare programs. Treatment is in a historical and institutional context. Primarily directed toward the development of ideas to guide determination of social work posture and context. Prerequisite: Social Work 311 or consent of instructor. 1/2 to 2 units.

485. **National Social Welfare Policy, II.** Emphasis is on the case approach within the context of basic political and governmental processes which influence the development, enactment, and application of national policy. Analytical study of the background, legislative history, amendments, judicial interpretations, and operation of major national acts comprising our national social welfare policy, or bearing directly on social welfare such as the Social Security Act, the Employment Act, the Civil Rights Acts, and the Economic Opportunity Act. Prerequisite: Social Work 484 or consent of instructor. 1/2 to 2 units.
491. **Research Seminar.** Seminar for students preparing research projects, either in groups or individually. Experience in the application of research methods to current social work problems. Prerequisite: Consent of instructor. 0 to 2 units.
492. **Seminar on Models for Directed Change.** Same as Sociology and Urban and Regional Planning 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels. Construction of models as interpretations of behavioral science theory; extrapolating of hypotheses and of guides to intervention from the models. Readings from several disciplines as relevant. Prerequisite: Consent of instructor. 1/2 to 1 unit.
493. **Methodological Issues in Social Work Research.** Analysis of issues and problems inherent in selected social research methods, to identify special problems in research on social work practice. Methodological problems of proof and verification, levels of generalizability, meaning of data objectivity and reliability in use of judgements. A framework is developed for reformulation of research problems and for selection of research methods. Prerequisite: One course in social research methods. 1/2 to 1 1/2 units.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations and Educational Administration 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector—federal, state and local. Analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.

SOCIOLOGY

Head of Department: Professor F. C. FLIEGEL

Department Office: 326 Lincoln Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours from courses in sociology, excluding Sociology 100. Sociology majors are required to take Sociology 184, 185, 300, at least one course from among 201, 212, 320, and 321 (the interpersonal relations area), and at least one course from among 218, 223, 322, and 270 (the societal analysis area).

Minors: Twenty hours in one or two of the following subjects with at least eight hours in each if two are chosen; anthropology, economics, history, mathematics, philosophy, political science, psychology, and social work. The curriculum in Russian language and area studies is also accepted as a minor.

Departmental Distinction: In order to be awarded distinction in sociology at graduation, the student must (1) have at least a 4.0 all-University grade-point average; (2) meet the general requirements for a major in sociology; and (3) in addition to the work done for the major, earn four semester hours of credit by enrolling in both of the honors courses (Sociology 290 and 291).

100. **Introduction to Sociology.** Introductory analysis and description of the structure and dynamics of human society. Special emphasis is placed on the application of scientific methods to the observation and analysis of social norms, groups, intergroup relations, social change, social stratification, and institutions. Credit is not given for Sociology 100 and Sociology 151 and 152, or Rural Sociology 117. 3 hours.
131. **Social Problems.** Introductory survey of sociological aspects of chief modern social problems, stressing the social interrelationships and cultural conflicts involved in their genesis, significance, and amelioration or prevention. Prerequisite: Three hours of sociology or eight hours of social science. 3 hours.
184. **Nonstatistical Introduction to Social Science Research Methods.** Emphasis is given to the formulation of social science issues as research questions, the various types of research methods and their advantages and disadvantages, the design of research programs, the analysis and appraisal of research findings, and research reporting. Major studies in sociology, political science, and anthropology are critically examined. Prerequisite: Sociology 100, or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours.
185. **Introduction to Social Statistics.** Same as Geography 185. A first course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100, or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours.
190. **Individual Topics for Undergraduates.** Individual study and investigation of selected problems in the sociological aspects of behavior. Prerequisite: Six hours of sociology or three hours of sociology and registration in another sociology course; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.
198. **Freshman Honors Seminar.** A seminar to provide intensive exposure to the problems and approaches of sociology as a discipline by means of research, reports, and discussion on a substantial topic in the field. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Social Psychology.** An introduction to the study of relationships between the functioning of social systems and the behavior and attitudes of individuals, with special reference to social and cultural factors in personality development and perceptual processes, and to role behavior and small group interaction. Credit is not given for both Sociology 201 and Psychology 201. Prerequisite: Sociology 100 or Rural Sociology 117. 4 hours.
202. **Sociology of Poverty.** Analysis of institutional structures which tend to maintain poverty in industrialized societies, particularly the United States, in the context of social stratification. Prerequisite: Three hours of sociology or eight hours of social science. 3 hours.
206. **Political Sociology.** An examination of the social contexts of political behavior, including behavior within formal organizations such as trade unions, the formation and maintenance of elite groups, and the development of movements for political change. The course focuses chiefly on the informal processes that impinge upon and occur within different institutions, illuminating such processes by reference to materials on political behavior in the United States as well as in other nations. 3 hours.
212. **Culture Patterns and the Individual.** Relationships between institutional structure and culture patterns and the common drives, attitudes, and other adjustive mechanisms of the group members. Prerequisite: Sociology 100; junior standing. 3 hours.
218. **Technology and Social Change.** The implication of science and technology for social change; effects of innovation upon social relationships in different cultures; theories of social change; the social effects of selected major inventions; a cross-cultural analysis of the processes of "industrialism." Prerequisite: Sociology 100 or equivalent. 3 hours.
221. **Contemporary Society.** Basic character of modern life forms; underlying principles and efforts at reorientation. Prerequisite: Sociology 100; junior standing. 3 hours.

223. **Stratification and Social Classes.** Systems of social ranking in human societies, with emphasis on the class structure of the United States; power, prestige, and privilege as related to class differences in the United States and other societies; the culture and styles of life of different classes; class and status as determinants of group interests, ideologies, and interaction; effects of social change and mobility on class structure. Prerequisite: Three hours of sociology or eight hours of social science. 3 hours.
225. **Racial and Cultural Minorities.** A sociological and social-psychological analysis of minority groups. Illustrative material drawn from representative racial, ethnic, and status groups. Prerequisite: Sociology 100; junior standing. 3 hours.
228. **Sociology of Leisure.** Problems surrounding increases in the amount of leisure; leisure as an index of values; leisure and industrialization; the Protestant ethic; the relevance of social organization, culture, stratification, the family, and occupation to the use of leisure; leisure subcultures; problems of mass culture; the classification of leisure activities. Prerequisite: Three hours of sociology or consent of instructor. 3 hours.
229. **Sociology of Religion.** Same as Religious Studies 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
231. **Analysis of Juvenile Delinquency.** Conceptions of delinquency and its causations; the juvenile court movement; juvenile detention; treatment of juvenile offenders; delinquency prevention programs. Prerequisite: Sociology 100. 3 hours. BORDUA.
240. **Collective Behavior.** The study of spontaneous, emergent, or transitory actions by large numbers of people not linked through formal organization, and not necessarily by common group identity: e.g., the phenomena of crowds, mobs, panics, disasters, rumors, booms, fads and fashions, audiences, masses, publics, propaganda targets, and social movements. Implications of this behavior from the standpoints of personal problems and social change. Prerequisite: Sociology 100. 3 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology, and Zoology 246. An introduction to the biosociology of the vertebrates. Emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications and Journalism 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours.
270. **Population and Human Ecology.** Same as Rural Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories and human ecology and current problems. Prerequisite: Sociology 100 or Rural Sociology 117; junior standing. 3 hours.
275. **Sociology and the Community.** Nature, structure, and functions of the community; types of communities and examples of some better community studies; the relation of the community to the larger social organizations. Prerequisite: Sociology 100. 3 hours.
276. **Sociology of the City.** Study of urban structure and ecology, particularly in light of the planning movement; urban populations; growth and development of urban communities. Prerequisite: Sociology 100; junior standing. 3 hours.
277. **Rural Social Change.** Same as Rural Sociology 277. Social forces retarding or accelerating change—traditions, beliefs, attitudes, innovation, social movements, and social planning—as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed \$5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.
290. **Honors Course.** Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.
291. **Honors Course.** Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.

300. **Twentieth-Century Sociological Theory.** Attempts to give some idea of four theoretical approaches: symbolic interactionism, structural-functional theory, conflict theory, and the reductionism of George Homans. Important theorists treated at varying length are Marx (the only one from the nineteenth century), Weber, Durkheim, Simmel, Mead, and Cooley. Living theorists, besides Homans, include Parsons, Merton, and Dahrendorf. Prerequisite: Sociology 100. 3 hours or 1 unit.
303. **Japanese Society.** Same as Asian Studies 303. The institutions of contemporary Japan and their historical roots, the Japanese approach to modernization and development and social change. Implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
306. **Youth and Politics.** This course addresses the issues of how and why young people in America and throughout the world become involved in political activities. The nature and style of youth politics is also examined. Along with an emphasis on political socialization, historical and cross-national perspectives are covered. Prerequisite: Sociology 206 is recommended. 3 hours or 3/4 unit.
309. **South Asian Social Organization.** An analysis of traditional and emergent features of social organization in South Asia. Includes analyses of family, caste, and village organization; political, economic, and religious change; urbanization; industrialization; and demography. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or 1/2 or 1 unit.
311. **Sociology of Intellectual Life.** A comparative sociological analysis of the development of the intelligentsia in Europe and elsewhere. Central concerns include the institutional supports for intellectual work under various social and cultural conditions, the social origin and status of different types of intellectuals, the formulation of distinct scientific traditions, and the relationship of these traditions to ideology, literature, and philosophy. This involves a critical scrutiny of the theoretical literature and methodology of the sociology of knowledge. Prerequisite: Sociology 100, eight hours in social science, or consent of instructor. 3 hours, or 1/2 or 1 unit.
315. **Sociology of Education.** Same as History and Philosophy of Education 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on the present education in countries which share Western civilization. Prerequisite: Sociology 100. 3 hours, or 1/2 or 1 unit.
316. **Sociology of Adolescence.** Adolescence in modern societies; social class, ethnic and minority group membership, and other variables as reflected in adolescent behavior; the problems of adolescence (discontinuities in social development, search for identity, intergenerational conflict, academic and social failure, and juvenile delinquency); the socializing institutions of family, education, peer culture, politics, religion, welfare, social control, the work world, and recreation and leisure; emphasis on research. Prerequisite: Sociology 100; junior standing. 3 hours or 1/2 or 1 unit.
317. **Sociology of Law.** A general treatment of the social origins and consequences of law and legal process. Special emphasis is placed on problems of legal change and on the structure and functioning of legal sanctions. Some attention is paid to law and law-like phenomena in other societies including primitive societies, but the main focus is on American society. Prerequisite: Sociology 100. 3 hours, or 1/2 or 1 unit.
318. **Industry and Society.** Same as Labor and Industrial Relations 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; the changing bases of managerial authority. Prerequisite: Sociology 100, or six hours of social science, or consent of instructor; junior standing. 3 hours, or 1/2 or 1 unit.
320. **Social Roles.** Contemporary role theory and related concepts such as social status and social interaction; age, sex, vocational, social class, and other role types; applications of this theory to the study of the socialization process and personal adjustment; and the analysis of critical group situations and social change. Prerequisite: Sociology 100; junior standing. 3 hours, or 1/2 or 1 unit.

321. **Family and Kinship.** An analysis of family and kinship, with major concentration on the American family. Implications of the American kinship system for trends in courtship and mate selection, interaction among kin, and other areas of family life are investigated. Prerequisite: Sociology 100, or eight hours of social science, or consent of instructor. 3 hours, or 1/2 or 1 unit.
322. **Sociology of Bureaucracy and Administrative Organization.** An analysis of major types of formal organization from the viewpoint of generalized theories of organization and of substantive theories of bureaucratization and rationalization. Among the formal organizations studied are business enterprises and unions, educational and medical institutions, and nonvoluntary organizations. The interrelations between bureaucracy, ideology, and social structure are particularly emphasized. Prerequisite: Nine hours of sociology including Sociology 300, or consent of instructor. 3 hours, or 1/2 or 1 unit.
323. **The Small Social Group.** Theory, observation, and analysis of face-to-face social groups, such as friendships, cliques, clubs, committees, and laboratory and experimental groups. Deals with characteristics, functions, and forms of interaction of small groups and covers recent theoretical and empirical developments in this field of sociology. Prerequisite: Sociology 201 or Psychology 201. 3 hours, or 1/2 or 1 unit.
324. **Penology.** Probation; parole; methods of institutional treatment. Prerequisite: Sociology 331. 3 hours, or 1/2 or 1 unit.
325. **The Philosophy of Social Science.** Same as Anthropology 329 and Philosophy 329. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
326. **Social Mobility and Class Structure.** An advanced course in social stratification, concerned with patterns, causes, and consequences of social mobility and immobility. Includes the analysis of rising and falling classes in industrial and developing countries and the circulation of political, social, and economic elites as well as institutional sources of individual mobility. Prerequisite: Sociology 223 or consent of instructor. 3 hours, or 1/2 or 1 unit.
328. **Sociology of Asian Religions.** Same as Religious Studies 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa, focused on the problems of social change and development. Concentration is on the religions and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Sociology 229 or consent of instructor. 3 hours, or 1/2 or 1 unit.
329. **Comparative Family Institutions.** Cross-cultural analysis of family institutions, with special reference to vital and demographic backgrounds, and with stress on property, authority, and handling of deviance, and relationship to religion, economy, and polity. Prerequisite: Sociology 185. 3 hours, or 1/2 or 1 unit.
331. **Criminology.** Nature and extent of crime; past and present theories of crime causation; criminal behavior in American society and its relation to personal and cultural conditions. Prerequisite: Sociology 100; junior standing; prelegal juniors may be admitted with consent of instructor. 3 hours, or 1/2 or 1 unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Psychology 332. A lecture and laboratory course in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 or 185; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or 1/2 or 1 unit.
333. **Sociology of Mental Health.** Mental health issues from social organizational, demographic, and social psychological perspectives; definitions of mental illness and treatment practices relating to changing social, psychological, and political ideologies. The patient and the mental hospital, and the potential role of the behavioral scientists as an agent of research, treatment, and change, with special reference to current mental health action programs, are discussed. Prerequisite: Sociology 100 and one course in abnormal and one in social psychology, or consent of instructor. 3 hours or 1 unit.

335. **Comparative Social Stratification.** Role of social stratification, nature of social class, class determinants of culture, and class dynamics in comparative perspective. Case studies of United States, slave society, European and Japanese feudalism, Russia, India, China, and a nonliterate society. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or 1/2 or 1 unit.
340. **Social Movements.** Analysis of the factors in the formation and dynamics of social movements as collective behavior; patterns of growth, types of leaders, control mechanisms. Prerequisite: Sociology 100 or 151. 3 hours, or 1/2 or 1 unit.
343. **Social Change in Developing Areas.** Same as Rural Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies. Special attention is given to problems of traditional social structure undergoing modernization. Social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, and family and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or 1/2 or 1 unit. FLIEGEL.
344. **Public Opinion.** Same as Communications 344. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. Prerequisite: Sociology 100 or 151; junior standing, 3 hours or 1/2 unit.
350. **Soviet Social Institutions.** Analyzes the major social institutions of Soviet society. Special attention is paid to the structural consequences of Communist ideology, totalitarianism, and industrialism, and to comparison with and implications for American society. The major areas covered are: population data and their sociological implications; history, values, and ideology; political institutions; economic institutions; social stratification and mobility; the nationalities; the family and education; communications and public opinion; socialized medicine. Prerequisite: Sociology 100 or consent of instructor. Students enrolled in Russian language and area studies as majors or minors are admitted without prerequisite or special permission. 3 hours, or 1/2 or 1 unit.
351. **Advanced Social Psychology.** Same as Communications and Psychology 351. An integrative treatment of individual behavior variables in relation to group variables. Prerequisite: Sociology 201 or Psychology 201 and Psychology 235 or Sociology 385 or a comparable statistics course. 3 hours, or 1/2 or 1 unit.
352. **Attitude Theory and Change.** Same as Communications and Psychology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change. Emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201 or a comparable course of introduction to social psychology. 3 hours, or 1/2 or 1 unit.
355. **Chinese Society.** Systematic treatment of China's social, cultural, and demographic heritage and of the impact of the West on an ancient civilization; the processes of planned and unplanned change in Chinese society. Topics include peasant-land economy, the family, patterns of social stratification and social mobility, the persistence of traditional forms, and the adoption and adaptation of new patterns. Prerequisite: Sociology 100 or Rural Sociology 117; or consent of instructor. 3 hours, or 1/2 or 1 unit.
359. **The Social Psychology of Organization.** Same as Psychology 359. Analysis of the interrelationships between social and psychological factors, on one hand, and organizational structure and process on the other. Emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Sociology 322 or Psychology 355. 3 hours or 1 unit.
360. **Sociology of the Professions.** This course examines the nature, position, functions, and growing importance of the major professions in the contemporary industrial (or industrializing) society. Particularly close attention is paid to the relationship between the social system and the various professional "communities," recruitment, professional socialization, and bureaucratic vs. independent practice. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or 1/2 or 1 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development

of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or 1/2 or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.

371. **Comparative Social Institutions.** This course examines, in a comparative perspective some of the major institutional complexes of social systems, such as family and kinship structures, occupations, political institutions, and social stratification and mobility. Illustrative materials are drawn from a variety of societies, including primitive, non-literate societies and advanced industrial societies such as the United States, Germany, and the Soviet Union. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or 1/2 or 1 unit.
373. **Latin-American Social Organization and Institutions.** Analysis of contemporary institutional and social class structures in Latin-American communities and societies, and their relationship to certain religious and family patterns; the influence of past and present trends in urbanization, ecological organization and population growth upon Latin-American social systems and institutional organization. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or 1/2 or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Sociology 369. 4 hours or 1 unit.
382. **Development of Sociological Thought.** A historical analysis of selected areas of sociological thought, stressing their existential base as meanings systems; includes the origin of sociology, its relation to social Darwinism, psychoanalysis, the debate over functionalism, and the cultural "relevance" of social theories generally; figures include Comte, Spencer, Sumner, Ward, Freud, Durkheim, Weber, etc. Prerequisite: Sociology 100, or eight hours of social science, or consent of instructor. 3 hours or 1 unit.
385. **Social Statistics, I.** Deals intensively with descriptive statistics, probability, statistical inference, and significance testing by means of both parametric and nonparametric tests, and the various measures of association. Prerequisite: Sociology 185, or Mathematics 122 or 123, or consent of instructor. 3 hours or 1 unit.
386. **Methods of Field Research.** Introduction, training, and supervised practice in methods of field research as a basic tool of sociology. Major emphasis is placed on the role of the field researcher as participant, observer, and interviewer in various kinds of research settings, and on approaches to and applications of field data. Each student develops and executes a field research project dealing with some aspect of institutional, occupational, or general community activity and structure. Prerequisite: Sociology 184 and 185. 3 hours, or 1/2 or 1 unit.
387. **Social Statistics, II.** Treats analysis of variance, analysis of covariance, multiple and partial correlations, and complicated sampling procedures. A semester problem is developed which emphasizes integration and application of various statistical techniques to sociological problems. Prerequisite: Sociology 385. 3 hours, or 3/4 or 1 unit.
400. **General Sociology.** Systematic sociology, with emphasis on the development and problems of modern structural-functional theory. Analysis of the works of major contributors to functionalism, e.g., Durkheim, Weber, Merton, and Parsons, and an examination of the ways in which their work converges to form a cumulative body of sociological theory. 1 unit.
405. **European Sociology—Recent Developments.** Analyses of recent developments and original contributions of European sociology. A review of the major sociological centers in France, Germany, Great Britain, Poland, Russia, and Scandinavia, and an emphasis on special problems selected on the basis of their theoretical importance. Prerequisite: Sociology 300. 1 unit.

- 406. Recent Developments in Sociological Theory in the United States.** The emphasis of this course is on American theorists other than Talcott Parsons. The specific theorists treated may vary somewhat from year to year. Prerequisite: Sociology 300. 1 unit.
- 407. Population Studies and Demographic Analysis.** Same as Rural Sociology 407. Nature and development of population theories; population growth and measures of fertility, reproduction, mortality, morbidity, and internal migration; indices, rates, and standardizations used in analyzing compositional characteristics. Methods in population projections, relationship of economic, sociological, and psychological factors to population changes. Prerequisite: Twelve hours of social science and introductory statistics or major in sociology, or consent of instructor. 1 unit.
- 408. The Sociology of Human Fertility.** Comparative studies of levels of fertility in different societies and in the same societies at different times. Analysis of sociological, psychological, and demographic factors affecting human reproduction and family planning, and consequences of differentials in fertility. Prerequisite: Graduate standing or consent of instructor. 1 unit.
- 409. Psychological Scaling.** Same as Psychology 409. Scaling theory and methodology, with emphasis upon measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit. Offered in 1972-1973 and in alternate years.
- 410. Crowd Behavior.** An examination of classic and contemporary theory and research bearing on crowd formation, form, relocation, and dispersal; and, the production, maintenance, and alteration of various behaviors within crowds. Emphasis given to direct observation of, and the design of field and laboratory research bearing on these phenomena. Prerequisite: Sociology 386. 1 unit.
- 411. Sociology of Science.** Social factors in the origin of broad theoretical orientations in science, such as the mechanistic doctrine, vitalism, historicism, atomism, holism, relativism, and indeterminism; social effects of these orientations; the social origin of scientists; ethos of science; the relationship of science to culture change; the variety and nature of scientific institutions. Prerequisite: Sociology 311 or consent of instructor. 1 unit.
- 413. Computer Applications in Social Statistical Research.** Same as Computer Science and Psychology 413. Computer procedures for the analysis of sociological and psychological data, including probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387. 1 unit. DICKMAN.
- 414. Seminar on Social Interaction.** Same as Communications 414. An analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas. Problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
- 415. Survey Research Methods, I.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course is devoted mainly to planning of the project. Sociology 416, which is devoted to execution of the research project, must be taken in the spring semester. For credit, both semesters must be taken in sequence. Three to ten hours of laboratory time per week. 1 unit.
- 416. Survey Research Methods, II.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course sequence will be devoted mainly to execution of the research project. For credit this course must be taken in the semester following Sociology 415. Three to ten hours of laboratory time per week. 1 unit.
- 417. Seminar in the Sociology of Law.** Review and analysis of selected areas of theory and research in the sociology of law. The focus varies from year to year. Topics covered in different years include such areas as civil litigation and the civil courts, police operations

and the sociology of law and order, sociological theories of justice and the operations of legal agencies. Students should consult the instructor about the area to be covered in a particular semester. Prerequisite: Sociology 317. 1 unit.

418. **Seminar in Industrial and Economic Sociology.** Same as Labor and Industrial Relations 418. Discussion and individual research on such topics as industrialization, labor-management relations as group relations, the interrelations of industry and community, technology and the structure of controls in industry, and the problem of a social economics. Prerequisite: Sociology or Labor and Industrial Relations 318, or consent of instructor. 1 unit.
421. **Seminar on Research in Marriage and Family Life.** Analysis of relationships between research methodology and conceptual schemes employed to study family life; critical examination of typical studies which illustrate alternatives in the conceptualization of family interaction and the nature of the family unit. Prerequisite: Consent of instructor. 1 unit.
422. **Theory of Social Groups.** A comparative survey of selected conceptual systems currently used for the analysis of human groups. The systems are examined with a view to determining the origins and referents of the concepts, their interrelations, and their utility as sources of testable generalizations relevant to the solution of empirical problems in group analysis. 1 unit.
424. **Sociological Analysis of Treatment Institutions.** Analysis of research on the social structure of prisons, training schools, and mental hospitals; sociological approaches to measuring the effects of innovations in institution organization and program; measuring the influence of institutional experience on the post-release behavior of its inmates. Class makes one or more trips to institutions; total travel cost for the term not to exceed \$10.00. Prerequisite: Sociology 324 and 333, or consent of instructor. 1 unit.
425. **Racial and Cultural Minorities.** A study of the factual and conceptual aspects of minority status as determined by racial and cultural criteria. Prerequisite: Undergraduate major or minor in sociology or anthropology. 1 unit.
426. **Sociological Research on the Extramural Treatment of Deviant Behavior.** Analysis of sociological research on community programs for the treatment and prevention of deviant behavior, including adjudication and disposition in delinquency and mental disorder, probation, parole, out-patient and day- or night-only care, work-release, community correctional treatment. Class makes one or more trips to observe field research; total cost for the term not to exceed \$10.00. Prerequisite: Sociology 324 and 333, or consent of instructor. 1 unit.
429. **Seminar in the Sociology of Religion.** Detailed examination of research in the sociology of religion; the substantive character of religious groups and institutions as revealed by this research; significance of the research in the light of sociological theory and of other fields of sociological concern; the value of the current research methodology. Prerequisite: Sociology 400. 1 unit.
431. **Seminar on Social Deviance.** Systematic analysis of advanced theory and research on the social process by which behavior becomes defined as deviant, the conditions promoting such behavior, and the career patterns of deviant persons, with particular attention to crime, delinquency, and mental disorder. Prerequisite: Sociology 331 and 333, or consent of instructor. 1 unit. BORDUA.
432. **Special Problems in Theory and Research on Deviant Behavior.** A seminar concerned with the critique of recent theory and research on selected problems in the study of delinquency, crime, and mental disorder, and the collaborative development of new theory and research designs. Prerequisite: Sociology 331 and 333, or consent of instructor. 1 unit.
440. **Political Sociology.** An analysis of the impact of social cleavages and cohesion on the operation of political institutions and movements; the place of conflict and power in sociological theory; composition and behavior of power elites; participation in political associations; national and local power structure; social functions of electoral behavior; modern national and mass political movements. Prerequisite: A course in sociological theory or consent of instructor. 1 unit.

- 444. Seminar in Public Opinion.** Same as Communications 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; mass media and public opinion. 1 unit.
- 449. The Sociology of Sport.** Same as Physical Education 449. Sociological analysis of sport with emphasis on sociological theory. Sport and games in cross-cultural analysis. Sport's structure and function in modern industrialized society. The system of sport in regard to its role structure, formal organization and professionalization; its differentiation along social class, age, and sex. Sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
- 450. Problems of Soviet Society in Transition.** This seminar examines certain major problems inherent in directed social change from agricultural to an industrial system under a totalitarian regime of the Soviet type. Attention is focused on such areas as the different phases of the revolutionary process, inconsistencies between ideological premises and the demands of industrialism, the unanticipated consequences of social change, the simultaneous impact upon the social system of industrialism and totalitarianism, and implications of the Soviet experience for other countries. Prerequisite: Consent of instructor. 1 unit.
- 456. Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Psychology 453. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.
- 457. Organizational Sciences, II.** Same as Business Administration 411, Political Science 461, and Psychology 454. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Sociology 456. 1 unit.
- 474. Survey Methods in Marketing Research.** Same as Business Administration 471. An analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Sociology 185 or Economics 171, or equivalent. 1 unit.
- 476. Urban Communities and Urbanization.** Intensive study of special aspects of the urbanization process as it affects the life of communities in this and in other countries. 1 unit.
- 477. Seminar on Community Organization.** Same as Rural Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
- 480. Sociological Theory and Method.** This course is concerned with the strategy and tactics involved in the construction of specific substantive theories, considering such problems as concept formation, the use and development of models, criteria of good theory, and the role of theory in the development of sociological research. 1 unit.
- 482. Recent Development in Sociology.** Intensive study of selected topics based on contemporary works of major importance in the development of sociological theory. 1 unit. Students may register for a total of 2 units credit.
- 484. The Sociological Theory of Talcott Parsons.** Systematic description of the social system and comparison with the personality and cultural subsystems within the general action system. Theory of structural change in social system is also examined. Prerequisite: Sociology 300 or 400. 1 unit.
- 485. The Sampling of Human Populations and Social Organizations.** Same as Business Administration and Psychology 485. This course covers procedures for selecting samples from and estimating population parameters for human populations and social organizations. The types of sample designs treated include simple random samples, stratified, and

cluster samples together with random number and systematic selection techniques. Emphasis is given to the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.

486. **Seminar on Experimental Sociology.** The logic, design, and analysis of laboratory and field experiments, with special emphasis on the controlled investigation of social process. Prerequisite: Sociology 385 or equivalent, or consent of instructor. 1 unit.
487. **Special Problems in Rural Sociology.** Same as Rural Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. 1/2 or 1 unit.
490. **Individual Topics in Sociology.** Supervised individual investigation or study of a topic not covered by regular courses. The topic selected by the student and the proposed plan of study must be approved by the adviser and the staff member who supervises the work. 1/2 to 2 units.
492. **Seminar on Models for Directed Change.** Same as Social Work and Urban and Regional Planning 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels. Construction of models as interpretations of behavioral science theory; extrapolating of hypotheses and of guides to intervention from the models. Reading from several disciplines as relevant. Prerequisite: Consent of instructor. 1/2 to 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Educational Psychology and Psychology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
499. **Thesis Research.** 0 to 4 units.

SPANISH, ITALIAN, AND PORTUGUESE

(Including Catalan, Romance Linguistics, and Rumanian)

Head of Department: Professor A. M. PASQUARIELLO

Department Office: 4080 Foreign Languages Building

Spanish

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty-four hours, excluding Spanish 101, 102, 103, 104, 107, 108, 111, 115, and including Spanish 211, 212, 221, 222. A minimum of one course must be taken from each of the following groups: (1) Spanish 241, 305, 306; (2) Spanish 242, 307, 308; (3) Spanish 309, 311, 314; (4) Spanish 331, 332; (5) Spanish 351, 352, Linguistics 300, 302. At least two literature courses must be taken at the 300 level.

Students anticipating a major or other advanced study in Spanish should consult the following advisers: Professor D. R. Hershberg, majors in Spanish; Professor J. S. Flores, majors in the teaching of Spanish.

Minors: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: education, English (excluding Rhetoric 101 and 102), French, German, Greek, history, Italian, Latin, Latin-American studies, library science, medieval civilization studies, philosophy, Portuguese, Russian.

Note: Students are advised to consult their departmental advisers concerning forthcoming revised major and minor statements.

101. **Elementary Spanish.** For students who have no credit in Spanish. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **Elementary Spanish.** Continuation of Spanish 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Spanish 101 or one year of high school Spanish. 4 hours.
103. **Intermediate Spanish.** Rapid reading review of grammar, composition, conversation. Prerequisite: Spanish 102 or two years of high school Spanish. 4 hours.
104. **Intermediate Spanish.** Continuation of Spanish 103. Prerequisite: Spanish 103 or three years of high school Spanish. 4 hours.
107. **Readings in Spanish (Spain).** Readings in Spanish with class discussions conducted entirely in English. With Spanish 108 this course may be substituted for Spanish 104 to satisfy the graduation requirement in the College. Spanish 107 and 108 do not satisfy the prerequisite requirement for Spanish 221 and 222, but may be followed by courses in oral and written Spanish. Prerequisite: Spanish 103 or a placement score showing high school achievement equivalent to Spanish 103. 3 hours.
108. **Readings in Spanish (Spanish America).** Readings in Spanish with class discussion conducted entirely in English. With Spanish 107 this course may be substituted for Spanish 104 to satisfy the graduation requirement in the College. Spanish 107 and 108 do not satisfy the prerequisite requirement for Spanish 221 and 222, but may be followed by courses in oral and written Spanish. Prerequisite: Spanish 107. 3 hours.
111. **Conversational Spanish.** Practice in spoken Spanish. May be substituted for Spanish 104 to satisfy the graduation requirement in the College. This course is terminal and does not serve as a prerequisite for Spanish 221 or 222 unless the student passes the Spanish 104 proficiency examination. Prerequisite: Spanish 103 or a placement score showing high school achievement equivalent to Spanish 103. 4 hours.
115. **Elementary Composition and Conversation.** A beginning composition and conversation course at the level of difficulty of Spanish 103-104; may be taken concurrently with Spanish 103 or 104. Does not count toward the major in Spanish. Prerequisite: Spanish 102 or two years of high school Spanish. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Literary Analysis.** The study of literary styles and techniques of analysis as applied to major genres of Hispanic literature. Prerequisite: Spanish 104 or consent of instructor. 2 hours.
209. **Spanish Language.** A practical course on Spanish phonology and morphology. Intensive drill in Spanish sound and verb systems and analysis of sentence structure. Prerequisite: Spanish 104 or consent of instructor. 3 hours.
211. **Oral Spanish.** Practice in speaking Spanish. To be taken concurrently with or subsequently to Spanish 209. Meets four hours per week. Prerequisite: Spanish 104. 2 hours.
215. **Intensive Spoken Spanish.** Intensive oral contact with Spanish. Meets five hours per week. Required for teacher-training majors in Spanish. Prerequisite: Spanish 211 or consent of instructor. 2 hours. May be repeated once for credit.
217. **Spanish Composition, I.** Basic composition course. Problems of written Spanish and principles of Spanish rhetorical patterns. Introduction to Spanish metrics and poetic forms. Weekly written exercises. Prerequisite: Spanish 209 and junior standing, or consent of instructor. 3 hours.
218. **Spanish Composition, II.** Continuation of Spanish 217. Principles of commercial written Spanish are incorporated. Prerequisite: Spanish 217 or equivalent. 3 hours.
232. **Culture of Spain.** Prerequisite: Spanish 104. 2 hours.
233. **Culture of Spanish America.** Prerequisite: Spanish 104. 2 hours.
240. **Spanish Literature: Medieval-Golden Age.** Introduction to major works and movements of the Middle Ages and the Golden Age. Prerequisite: Spanish 200 or consent of instructor. 3 hours.
241. **Spanish Literature: Eighteenth Century to the Present.** The study of representative

- masterpieces within the context of major periods and trends. Prerequisite: Spanish 200 or consent of instructor. 3 hours.
242. **Spanish-American Literature.** Introduction to major literary movements and works in Spanish America. Prerequisite: Spanish 200 or consent of instructor. 3 hours.
280. **Teachers Course.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 211 and 212, or 222. 2 hours.
291. **Senior Thesis.** For candidates for honors in Spanish. 2 hours.
292. **Senior Thesis.** For candidates for honors in Spanish. 2 hours.
299. **Senior Seminar.** Intensive study of Hispanic linguistics or literature. Prerequisite: Senior standing. 2 hours. May be repeated for credit with adviser's consent.
305. **Romanticism and Realism in Nineteenth-Century Spanish Literature.** A study of representative authors and genres of the nineteenth century, with particular emphasis on the romantic drama and the realistic novel. Prerequisite: Spanish 241 or equivalent. 3 hours or 1/2 unit. COWES, LOTT, PASQUARIELLO.
306. **The Generation of 1898.** A study of representative works of Baroja, Azorin, Unamuno, Maeztú, Valle Inclán, Benavente, A. Machado, and others. Prerequisite: Spanish 241 or equivalent. 3 hours or 1/2 unit. COWES, LOTT, PASQUARIELLO.
307. **Spanish-American Literature to 1888.** Study of the development of Spanish-American literature from the sixteenth century through the end of the Romantic period. Prerequisite: Spanish 242 or equivalent. 3 hours or 1/2 unit. FORSTER, LEAL, MEEHAN.
308. **Spanish-American Modernismo.** A study of Spanish-American literature from 1888 to the end of World War I. Prerequisite: Spanish 242 or equivalent. 3 hours or 1/2 unit. FORSTER, LEAL, MEEHAN.
309. **Introduction to Medieval Spanish Literature.** Historical and cultural background for the Middle Ages; selected readings in medieval literature from the *Jarchas* to *Corbacho*. Prerequisite: Spanish 240 or equivalent. 2 hours or 1/2 unit. BALDWIN.
310. **Contemporary Spanish-American Literature.** A study of Spanish-American literature from World War I to the present. Prerequisite: Spanish 242 or equivalent. 3 hours or 1/2 unit. FORSTER, FRANCESCATO, LEAL.
311. **Don Quixote and the Prose of the Golden Age.** Introduction to *Don Quixote*, to its relationship to other selected masterpieces of the Golden Age, and to the main currents and forms of Golden Age prose. Prerequisite: Spanish 240 or equivalent. 2 hours or 1/2 unit. HERSHBERG, PORQUERAS-MAYO.
314. **Spanish Drama and Poetry of the Golden Age.** Prerequisite: Spanish 240 or equivalent. 2 hours or 1/2 unit. FLORES, HERSHBERG, PORQUERAS-MAYO.
351. **Phonetics.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or equivalent. 2 hours or 1/2 unit. ALLEN, BALDWIN, FLORES, SALTARELLI, WANNER.
352. **Syntax.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or equivalent. 2 hours or 1/2 unit. BLAYLOCK, FLORES, SALTARELLI, WANNER.
353. **Spanish Structure.** Comprehensive analysis of Spanish phonology and syntax based on present-day linguistic theory. Prerequisite: Linguistics 300, Spanish 351, Spanish 352. 3 hours or 1/2 unit. SALTARELLI, WANNER.
361. **Spanish Abroad, I.** Lectures, seminars, and practical work in Spanish language, literature, and civilization, in Spain. Prerequisite: Spanish 211 or equivalent; Spanish 200 or equivalent; 3.5 overall average; 4.0 average in Spanish courses. 0 to 15 hours, or 0 to 4 units.
362. **Spanish Abroad, II.** Lectures, seminars, and practical work in Spanish language; literature, and civilization, in Spain. Prerequisite: Spanish 361. 0 to 15 hours, or 0 to 4 units.
364. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or 1/2 unit. SALTARELLI, WANNER.

371. **Spanish for Teachers.** A consideration of language problems suggested by teaching experience. Prerequisite: Spanish 209 or equivalent. 2 hours or 1/2 unit. Offered in the summer session only. FLORES.
382. **Language Laboratory Techniques.** Same as French, German, and Slavic 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity. Instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or 1/2 unit.
400. **Beginning Spanish for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 semester hours. No graduate credit.
401. **Readings in Spanish for Graduate Students.** Continuation of Spanish 400, with special readings in the critical literature of several disciplines. Prerequisite: Spanish 400 or consent of instructor. 4 semester hours. No graduate credit.
405. **Spanish Bibliography.** An introduction to bibliographical method and to the principal bibliographical resources for the study of Spanish and Latin-American literature. 1/2 unit. BLAYLOCK and others.
411. **Spanish Literature in the Middle Ages.** Prerequisite: Spanish 309. 1 unit. ALLEN, BALDWIN.
415. **Renaissance and Baroque Prose in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit. HERSHBERG; PORQUERAS-MAYO.
417. **Renaissance and Baroque Drama in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit. FLORES, HERSHBERG, PORQUERAS-MAYO.
418. **Seminar in Renaissance and Baroque Literature.** 1 unit. May be repeated for credit. HERSHBERG, PORQUERAS-MAYO.
419. **Cervantes. *Don Quixote*** and representative minor works. Prerequisite: Spanish 311 and 314, or equivalent. 1 unit. PORQUERAS-MAYO.
421. **Modern Spanish Novel and Essay.** 1 unit. COWES, LOTT.
422. **Contemporary Spanish Novel and Essay.** 1 unit. COWES, LOTT, PASQUARIELLO.
423. **Modern Spanish Drama.** 1 unit. LOTT, PASQUARIELLO, PIETRANGELI.
424. **Contemporary Spanish Drama.** 1 unit. COWES, LOTT, PASQUARIELLO.
425. **Renaissance and Baroque Poetry in Spain.** 1 unit. PORQUERAS-MAYO.
426. **Spanish Poetry of the Nineteenth and Twentieth Centuries.** 1 unit. PIETRANGELI.
427. **Studies in Twentieth-Century Spanish Literature.** Advanced study of major literary movements, genres, or authors in twentieth-century Spanish literature. The subject matter of the course is variable. Prerequisite: Spanish 306 or any survey of contemporary Spanish literature, or equivalent. 1 unit. May be repeated for credit for a total of 2 units.
428. **Studies in Nineteenth-Century Spanish Literature.** Advanced study of major literary movements, genres, or authors in nineteenth-century Spanish literature. The subject matter of the course is variable. Prerequisite: Spanish 305 or equivalent. 1 unit. May be repeated for credit for a total of 2 units.
429. **Studies in Golden Age.** Advanced study of major literary movements, genres, or authors in sixteenth- and seventeenth-century Spanish literature. The subject matter of the course is variable. Prerequisite: Spanish 311 or 314 or any survey of Spanish literature. 1 unit. May be repeated for credit for a total of 2 units.
430. **Studies in Twentieth-Century Spanish-American Literature.** Advanced study of major literary movements, genres, or authors in twentieth-century Spanish-American literature. The subject matter of the course is variable. Prerequisite: Spanish 307, 308, or 310, or equivalent. 1 unit. May be repeated for credit for a total of 2 units.
431. **Spanish-American Poetry to 1920.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit. FORSTER.
432. **Contemporary Spanish-American Poetry.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit. FORSTER.

433. **Spanish-American Novel to 1945.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit. LEAL, MEEHAN.
434. **Spanish-American Novel Since 1945.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit. LEAL, MEEHAN.
435. **Seminar in Spanish-American Poetry.** Prerequisite: Spanish 431 or 432. 1 unit. FORSTER.
436. **Seminar in Spanish-American Novel.** Same as Comparative Literature 462. Special problems in methodology and research. Includes other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit. LEAL.
437. **Spanish-American Drama.** Prerequisite: Spanish 307, 308, or 310. 1 unit. FORSTER.
438. **Spanish-American Essay.** Prerequisite: Spanish 307, 308, or 310. 1 unit. LEAL.
439. **The Spanish-American Short Story.** Intensive and analytical study of the principal *cuentistas* of Spanish America. Prerequisite: Spanish 307, 308, or 310, or equivalent. 1 unit. LEAL.
442. **Seminar in Modern Spanish Literature.** Study of problems in the works of a major writer or group of writers of the eighteenth or nineteenth centuries. Prerequisite: Spanish 305; Spanish 421 or 423, or equivalent. 1 unit. COWES, LOTT.
443. **Seminar in Galdos.** Research work in novelistic criticism. Prerequisite: Spanish 305 or 306 and 311 or 314; Spanish 421 or 422. 1 unit. LOTT.
444. **Seminar in Spanish Realism and Naturalism.** Research work in nineteenth-century literary theory and practice in novel and drama. Prerequisite: Spanish 421 and 442. 1 unit. COWES, LOTT.
445. **Seminar in Twentieth-Century Spanish Literature.** Prerequisite: Spanish 421 or 422, or 423 or 424, or equivalent. 1 unit. COWES, LOTT, PASQUARIELLO.
451. **Seminar in Spanish Descriptive Linguistics.** Selected topics of Spanish phonology and syntax in the light of present-day linguistic theory. Prerequisite: Consent of instructor. 1 unit. SALTARELLI.
452. **Seminar in Spanish Historical Linguistics.** Selected topics on the development of Spanish and its dialects in the light of present-day historical methods. Prerequisite: Consent of instructor. 1 unit. BLAYLOCK.
453. **History of the Spanish Language.** 1 unit. BLAYLOCK.
454. **Old Spanish.** 1 unit. BLAYLOCK.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 462. Selected topics in comparative Romance linguistics. Prerequisite: Spanish 362 or consent of instructor. 1 unit. BLAYLOCK, SALTARELLI, WANNER.
463. **College Teaching of Foreign Languages.** Same as French, German, and Russian 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, literary appreciation; the use of technology; recent experimentation. 1 unit.
471. **Applied Linguistics and Teaching College Spanish.** A study of the structure of Spanish with special emphasis on the teaching situation in elementary Spanish courses. 1/2 unit. SALTARELLI.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, German, and Russian 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, language as an aspect of culture and societal relations. Prerequisite: Spanish 463 or consent of instructor.
491. **Special Topics in Spanish.** 1/2 or 1 unit.
499. **Thesis Research.** 0 to 4 units. ALLEN, BALDWIN, BLAYLOCK, COWES, FLORES, FORSTER, HERSHBERG, LEAL, LOTT, MEEHAN, PASQUARIELLO, PIETRANGELI, PORQUERAS-MAYO, PRETO-RODAS, SALTARELLI.

Italian

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in Italian, excluding Italian 101 and 102 and including at least five hours from the group for advanced undergraduates and graduates. Linguistics 300 and Italian 291 and 292 are acceptable. Italian 291 and 292 for majors can be arranged for advanced group credit. Students anticipating a major or other advanced study in Italian should consult Professor Angelina R. Pietrangeli for a revised statement of majors.

Minors: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: education, English (excluding Rhetoric 101 and 102), French, German, Greek, history, Latin, library science, medieval civilization studies, philosophy, Portuguese, Russian, Spanish.

101. **Elementary Italian.** For students who have no credit in Italian. All students in this course are required to register for one hour of work weekly in the language laboratory 4 hours.
102. **Elementary Italian.** Continuation of Italian 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Italian 101 or one year of high school Italian. 4 hours.
103. **Intermediate Italian.** Rapid reading, review of grammar, composition, conversation. Prerequisite: Italian 102 or two years of high school Italian. 4 hours.
104. **Intermediate Italian.** Continuation of Italian 103. Prerequisite: Italian 103 or three years of high school Italian. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
209. **Italian Syntax and Phonetics.** An introduction to the advanced study of the language, with elements of applied phonetics and syntax. Prerequisite: Italian 104 or consent of instructor. 3 hours.
211. **Composition and Conversation, I.** Training in oral-aural skill and in writing. Practice in the language laboratory is required. Prerequisite: Italian 104 or consent of instructor. 3 hours.
212. **Composition and Conversation, II.** Continuation of Italian 211. Prerequisite: Italian 211 or consent of instructor. 3 hours.
221. **Introduction to Italian Literature, I.** Introduction to representative works and movements of Italian literature since the Renaissance. Prerequisite: Italian 104 or consent of instructor. 3 hours.
222. **Introduction to Italian Literature, II.** Introduction to representative works and movements of Italian literature in the Middle Ages and the Renaissance. Prerequisite: Italian 221 or consent of instructor. 3 hours.
290. **Readings in Italian.** Readings chosen in consultation with an adviser. Prerequisite: Italian 104 or consent of instructor. 2 to 4 hours. May be repeated for credit.
291. **Senior Thesis.** For candidates for honors in Italian. 2 hours.
292. **Senior Thesis.** For candidates for honors in Italian. 2 hours.
311. **Dante: La Divina Commedia, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or 1/2 unit. PIETRANGELI.
312. **Dante: La Divina Commedia, II.** Prerequisite: Italian 311 or consent of instructor. 3 hours or 1/2 unit. PIETRANGELI.
313. **The Divine Comedy.** Same as Comparative Literature 313. An interpretation of Dante's *Divine Comedy* with special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or 1/2 unit.
321. **Modern Italian Literature, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or 1/2 unit. CASSEL, PIETRANGELI.
322. **Modern Italian Literature, II.** Prerequisite: Italian 321 or 322, or consent of instructor. 3 hours or 1/2 unit. CASSEL, PIETRANGELI.

331. **Italian Culture.** Introduction to factors that have shaped present-day Italy: basic concepts contributing to understanding its present social and cultural development. Prerequisite: Italian 211 or 221, or consent of instructor. 3 hours or 1/2 unit.
362. **Introduction to Romance Linguistics.** Same as French, Linguistics, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or 1/2 unit.
400. **Beginning Course for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 semester hours. No graduate credit.
403. **Storia della letteratura italiana, I.** Intellectual and literary movements in Italy from the thirteenth century to the Renaissance. 1 unit. May be repeated for credit. MONTANO.
404. **Storia della letteratura italiana, II.** Intellectual and literary movements in Italy from the Baroque to the present. Prerequisite: Italian 403. 1 unit. May be repeated for credit. MONTANO.
409. **Storia della poesia di Dante.** Philosophical and literary interpretation of Dante's works. Prerequisite: Italian 311 or 312 or 313, or equivalent. 1 unit. MONTANO.
411. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit. CASSELL, PIETRANGELI.
412. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit. CASSELL, PIETRANGELI.
415. **Italian Literature of the Renaissance.** 1 unit. CASSELL, PIETRANGELI.
416. **Italian Literature of the Renaissance.** 1 unit. CASSELL, PIETRANGELI.
422. **Manzoni e il romanticismo europeo.** Manzoni and the Romantic Movement. Prerequisite: Italian 321 and 322, or equivalent. 1 unit. MONTANO.
451. **History of the Italian Language.** 1 unit. SALTARELLI, WANNER.
452. **Seminar in Italian Linguistics.** 1 unit. WANNER.
462. **Seminar in Romance Linguistics.** Same as French, Linguistics, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Romance Linguistics 362 or consent of instructor. 1 unit.
491. **Special Topics in Italian.** 1/2 or 1 unit.
499. **Thesis Research.** 0 to 4 units. MONTANO, PIETRANGELI, SALTARELLI.

Portuguese

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: Twenty hours in Portuguese excluding Portuguese 101 and 102, and including Portuguese 201 and at least six hours of Portuguese from the group for advanced undergraduates and graduates. Either Linguistics 300, Introduction to Linguistics, or Linguistics 302, Comparative Linguistics, may be counted toward the major in Portuguese.

Minor: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: anthropology, English (excluding Rhetoric 101 and 102), French, geography, German, history, Italian, Latin-American studies, library science, linguistics, medieval civilization studies, philosophy, political science, Russian, Spanish.

Note: The adviser for Portuguese courses is Professor R. Preto-Rodas. Students are advised to consult the departmental adviser concerning a revised major and minor statement.

101. **Elementary Portuguese, I.** For students who have no credit in Portuguese. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.
102. **Elementary Portuguese, II.** Continuation of Portuguese 101. Prerequisite: Portuguese 101. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.

103. **Intermediate Portuguese.** Rapid reading, review of grammar, composition, and conversation. Prerequisite 102 or 111, or two years of high school Portuguese. 4 hours.
104. **Intermediate Portuguese.** Continuation of Portuguese 103. Prerequisite: Portuguese 103 or three years of high school Portuguese. 4 hours.
111. **Elementary Portuguese.** For students who have no credit in Portuguese. All students in this course are required to register for two hours per week in the language laboratory. 8 hours.
112. **Intermediate Portuguese.** Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 8 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
209. **Portuguese Syntax and Phonetics.** An introduction to the advanced study of the language with basic elements of applied phonetics and syntax. Must be taken with Portuguese 211. Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours.
211. **Composition and Conversation, I.** Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours.
212. **Composition and Conversation, II.** Prerequisite: Portuguese 211 or consent of instructor. 3 hours.
221. **Introduction to Portuguese Literature.** A survey of the most representative works from the Middle Ages to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 104 or 112, or consent of instructor upon demonstrating competency in reading Portuguese. 3 hours.
222. **Introduction to Brazilian Literature.** A survey of the most representative works from the sixteenth century to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours.
290. **Readings in Portuguese.** Readings chosen in consultation with a departmental adviser. Prerequisite: Portuguese 104 or 112, or consent of instructor. 2 to 4 hours.
301. **Introduction to Brazilian Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or 1/2 unit. AIEX, FORSTER, PRETO-RODAS.
302. **Introduction to Portuguese Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or 1/2 unit. AIEX, FORSTER, PRETO-RODAS.
303. **Luso-Brazilian Culture.** Designed to afford a broad understanding of the origins of Luso-Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or 1/2 or 1 unit. AIEX.
304. **Brazilian Culture.** Designed to afford a broad understanding of contemporary Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or 1/2 or 1 unit. AIEX.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or consent of instructor. 3 hours or 1/2 unit.
405. **Structure of Brazilian Portuguese: Phonology.** Phonetics and phonemics of modern Brazilian Portuguese. Prerequisite: Portuguese 104 or consent of instructor. 1 unit. ALLEN.
406. **Structure of Brazilian Portuguese: Morphology and Syntax.** Morphemics and syntax of modern Brazilian Portuguese. Prerequisite: Portuguese 405 or consent of instructor. 1 unit. ALLEN.
407. **Studies in Brazilian Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Brazilian literature. The subject matter of the course varies each time the course is offered. Prerequisite: Portuguese 301 or consent of instructor. 1 unit. ALLEN, PRETO-RODAS.
408. **Studies in Portuguese Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Portuguese literature. The subject matter is variable and may be repeated for a total of 2 units. Prerequisite: Portuguese 302 or consent of instructor. 1 unit. PRETO-RODAS.

462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Portuguese 362 or consent of instructor. 1 unit.
491. **Special Topics in Portuguese.** 1/2 or 1 unit.
499. **Thesis Research.** 0 to 4 units. ALLEN, FORSTER, PRETO-RODAS.

Catalan

301. **Studies in Catalan Language.** An introductory study of the Catalan language. Prerequisite: Eight hours of Latin or any Romance language. 2 hours or 1/2 unit.
302. **Studies in Catalan Literature.** An introductory study to major works of Catalan literature. Prerequisite: Catalan 301. 2 hours or 1/2 unit.

Romance Linguistics

362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, and Portuguese 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or 1/2 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Romance Linguistics 362 or consent of instructor. 1 unit.

Rumanian

301. **Structure of Rumanian.** Analysis of the sound system and grammar of contemporary literary Rumanian. 3 hours or 1/2 unit.
302. **Structure of Rumanian.** Analysis of the sound system and grammar of contemporary literary Rumanian. Prerequisite: Rumanian 301. 3 hours or 1/2 unit.

SPECIAL EDUCATION

Chairman of Department: Professor M. SPRIGGS

Department Office: 1005 West Nevada Street, Urbana

117. **Exceptional Children.** An introduction to the study of children who deviate from the average in mental, physical, and social characteristics, including a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. Prerequisite: Sophomore standing and/or Psychology 100. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
249. **Independent Study.** Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Senior standing. 2 hours.
302. **Manual Communication, I.** Study of methods of manual communication with hearing

- impaired individuals; analysis of the language of signs and fingerspelling in relation to origins, development, and structure. Extensive practice in manual communication. 2 hours or 1/2 unit.
- 303. Manual Communication, II.** Continuation of Special Education 302. In-depth study of manual methods of communicating with hearing-impaired individuals, with particular emphasis on development of fluency in communicating with language-deficient deaf children and adults. Extensive practice in idiomatic language of signs. Prerequisite: Special Education 302 or consent of instructor. 2 hours or 1/2 unit.
- 314. Laboratory in Measurement of Exceptional Children.** Practice in administering, scoring, interpreting, and communicating the results of educational tests which may appropriately be given to exceptional children by classroom teachers. Practicum sections are offered by areas of exceptionality: mental retardation, learning disabilities, gifted, deaf, emotionally disturbed, culturally disadvantaged. Prerequisite: Credit or registration in Special Education 324; consent of instructor. 2 hours or 1/2 unit. May be repeated once; maximum credit is not to exceed 4 hours or 1 unit.
- 315. Psychoeducational Programming for Emotionally Disturbed Children.** Skill building experience in teaching emotionally disturbed children. Classroom focus is on developing skills in instructional alternatives, observational analysis, analyzing behavior, diagnosis, behavioral management, remediation procedures, curriculum considerations, relationship process, and personal-professional characteristics needed to teach emotionally disturbed children. Prerequisite: Special Education 321; consent of instructor. 4 hours or 1 unit.
- 316. The Gifted Child in School and Society.** A consideration of the gifted in society; who they are, their physical, psychological, social, and educational characteristics, and society's needs and provisions for them. The major portion of the course is devoted to the consideration and evaluation of instructional and administrative adjustments that should be made for the gifted in the educational structure. Prerequisite: Educational Psychology 211 or 236; consent of instructor. 3 hours, or 1/2 to 1 unit.
- 317. Psycho-Social Educational Aspects of Deafness.** Historical and current societal perceptions of the deaf; an analysis of the various effects and patterns of auditory impairment on children and adults; intelligence, personal, and social adjustment, the psychological processes and how they affect the acquisition of language, speech, speech reading, reading, and writing. Prerequisite: Special Education 117, and Psychology 100 or Educational Psychology 211. 3 hours, or 1/2 to 1 unit.
- 318. Workshop and Laboratory in Education of Exceptional Children.** For those specializing in exceptional children. The following sections may be offered: (a) mental retardation, (b) learning disabilities, (c) gifted children, (d) deaf children, (e) emotionally disturbed children, (f) programmed learning for exceptional children, and (g) culturally disadvantaged. Prerequisite: Consent of instructor. 4 to 8 hours, or 1 to 2 units.
- 319. Special Education of the Deaf, I.** Survey of the curriculum and techniques in pre-schools, kindergarten, primary, and intermediate levels as applied to the hard-of-hearing, deafened, and deaf child; study of sense training, lip reading, vocabulary development, reading techniques, elementary school subjects, language and speech development, auditory training, and curriculum construction. Prerequisite: Consent of instructor. 5 hours, or 1 to 1 1/2 units.
- 320. Special Education of the Deaf, II.** Continuation of Special Education 319. Prerequisite: Special Education 319. 5 hours, or 1 to 2 units.
- 321. Education of Disturbed and Conduct-Problem Children.** A study of the social, emotional, and learning characteristics of children who are disturbed or who exhibit problems of conduct; methods of diagnosis and differentiation; educational environments and teaching methods used for their remediation. Prerequisite: Special Education 117 or equivalent; Educational Psychology 236 or equivalent. 3 hours, or 1/2 or 1 unit.
- 322. Psychology and Education of the Mentally Handicapped, I.** A study of the social, emotional, physical, and learning characteristics and problems of mentally handicapped children; identification and diagnosis; available services and provisions; educational

programs and curriculum of the school. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.

323. **Psychology and Education of the Mentally Handicapped, II.** Techniques, methods, and materials for teaching mentally handicapped children; principles underlying course of study, parent counseling, and use of records. Prerequisite: Senior standing in special education; consent of instructor. 3 hours or 1/2 unit.
324. **Mental and Educational Measurement of Exceptional Children.** Theoretical and practical considerations in psychological and educational evaluation of exceptional children. Emphasis is placed on understanding the technical and practical aspects of current testing procedures and their application to the education of exceptional children. Prerequisite: Special Education 117; consent of instructor. 3 hours or 1/2 unit.
416. **Problems in Mental Deficiency.** An advanced course in mental deficiency, covering definitions, theories, classifications, etiology, diagnosis, and social, medical, psychological, and educational rehabilitation procedures. Emphasis is on the contributions of biology, sociology, anthropology, and psychology to educational theory and practice with reference to the mentally deficient. Prerequisite: Special Education 322 or consent of instructor. 1 unit.
417. **Psycho-Educational Problems of Exceptional Children.** A course for educators, students in the behavioral sciences, and students beginning graduate study in special education. Study of relevant research dealing with the physical, mental, emotional, and social traits of all types of exceptional children and consideration of major current problems in the development of educational programs. Prerequisite: Sixteen hours of psychology and/or education, or consent of instructor. 1 unit.
418. **Communicative Problems of the Deaf.** An advanced course in the problems and procedures involved in the acquisition of language and communication by persons with severe hearing impairment, particularly those with profound prelingual deafness. Emphasis is placed on research and measurement in the development of speech, speech-reading, residual hearing, reading, written language, and manual communication, including finger spelling and the language of signs. The applications of recent approaches in linguistics and psycholinguistics to language development are stressed. Prerequisite: Consent of instructor. 1 unit.
419. **Diagnosis of Learning Disabilities.** A course covering the advanced theory and technology of learning disabilities with special reference to etiology and diagnosis. The main emphasis is on the psychoneurological, genetic, and psycholinguistic aspects of reading disorders. Remediation which is implicit in diagnostic procedure is also covered. Laboratory practice is required. This is the first half of a year's sequence with Special Education 444. Prerequisite: Special Education 318 (b); Psychology 443 or Educational Psychology 343; Special Education 456 (b); consent of instructor. 1 unit.
420. **The Social Psychology of the Handicapped.** A study of the social and emotional adjustment of handicapped children and adults, and of the somatopsychological significance of mental, sensory, and motor variations in the adjustive process. The effects of limitations imposed by the attitude of society, the attitude of the individual toward his handicap, and the handicap itself are evaluated. Implications for current educational programs for the handicapped are analyzed. Prerequisite: Special Education 117 or 417 and Educational Psychology 312, or consent of instructor. 1 unit.
421. **Administration and Supervision of Special Education.** Designed for advanced graduate students preparing for administrative or supervisory positions in special education programs. Administrative and supervisory practices in educating exceptional children are examined with emphasis on special education programs in the public schools; application of administrative theory to special education programs. Field trips to observe and evaluate programs are required. Prerequisite: Special Education 417; Educational Administration and Supervision 460; consent of instructor. 1 unit.
444. **Remediation of Learning Disabilities.** The course covers the theory and practice of remediation of children with learning disabilities, with emphasis on matching a wide variety of methods to specific deficits. Advanced diagnostic procedures and teaching,

prescription writing, and evaluative monitoring are covered. The course includes supervised clinical practice. Prerequisite: Special Education 318 (b) and 419. 1 unit.

- 449. Independent Study.** To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
- 456. Problems and Trends in Special Education.** Introduces the student to significant problems, points of view, and trends in the field concerned. Significant research related to organization, content, and techniques in the field in question is explored. Students are encouraged to make special studies in approved areas. Sections may be offered in the following fields: (a) mental retardation, (b) learning disabilities, (c) gifted children, (d) deaf children, (e) emotionally disturbed children, (f) programmed learning for exceptional children, (g) culturally disadvantaged children, and (h) administration. Prerequisite: Consent of instructor. 1 to 2 units.
- 459. Workshop in Curriculum Development.** Curriculum development projects in specialized fields of special education. Sections may be offered in the following fields: (a) mental retardation, (b) learning disabilities, (c) gifted children, (d) deaf children, (e) emotionally disturbed children, (f) programmed learning for exceptional children, (g) culturally disadvantaged children, and (s) preschool. 1 to 2 units.
- 490. Seminar for Advanced Students of Education.** Seminar in the education of exceptional children open only to persons who have been admitted for doctoral study. Sections may be offered in the following fields: (a) mental retardation, (b) learning disabilities, (c) gifted children, (d) deaf children, (e) emotionally disturbed children, (f) programmed learning for exceptional children, (g) culturally disadvantaged children, (h) administration, (u) behavior modification, and (x) special education. 1 to 2 units.
- 491. Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
- 499. Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

SPEECH

Head of Department: Professor R. E. NEBERGALL

Department Office: 244 Lincoln Hall

REQUIREMENTS FOR L.A.S. STUDENTS IN SCIENCES AND LETTERS CURRICULUM

Major: A student intending to major in speech should consult with the department regarding major requirements.

Minors: Twenty hours in one or two College of Liberal Arts and Sciences departments or in interdepartmental programs approved by the College. Minor programs outside the College of Liberal Arts and Sciences may be arranged with the approval of the student's major adviser and his department head. If two minor subjects are chosen, at least eight hours must be included in each.

A minor program in English may not include more than three hours in literature courses open to freshmen and sophomores and may not include Rhetoric 101, 102, 151, 271, and 272. No language courses may satisfy the requirements for a minor if they are excluded from the major in that language.

Note: Two teacher-training curricula are offered in speech. See the curriculum preparatory to speech correction work and the curriculum to the teaching of speech in the Undergraduate Study catalog.

101. **Principles of Effective Speaking.** Preparation and presentation of short informative and persuasive speeches, with emphasis on the selection and organization of material, methods of securing interest and attention, and the elements of delivery. 3 hours. DELIA. (Chairman).
105. **Voice and Articulation.** Basic factors of voice and speech sound production and analysis of faults that result in minor speech deviations or inadequacies; individual analysis and guided practice toward improvement of speech habits. 2 hours. PADEN.
107. **Parliamentary Procedure.** Principles and practice of parliamentary procedure. 2 hours. BROADRICK.
109. **Introduction to Physiological Phonetics.** Basic analysis of the physiological process of producing the sounds of American English; practice in identification and in transcription of normal and deviant speech, especially for speech correctionists, hearing therapists, teachers of speech, and teachers of the deaf. 3 hours. PADEN.
111. **Verbal Communication.** Writing, reading, speaking, and listening; study of theory and practice. This course meets the requirement for Rhetoric 101. 4 hours. THOMAS (Chairman).
112. **Verbal Communication.** Continuation of Speech 111. This course meets the requirement for Rhetoric 102. Prerequisite: Speech 111. 4 hours. THOMAS (Chairman).
113. **Group Discussion and Conference Leadership.** Study of leadership, group process, and interpersonal relations in the small group, conference, and the public forum, with emphasis on practice in leading and participation in various types of public discussion and conference, with materials drawn from current public questions. Prerequisite: Sophomore standing. By permission of the head of the the prerequisite may be waived for superior students, including James Scholars. 3 hours.
121. **Advanced Public Speaking: The Logical Bases of Discourse.** Study of the theory of argument, e.g., evidence, reasoning, and construction of briefs; practice in formal and informal forms of debate and public discourse on current public questions. Prerequisite: Speech 101; sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours. CLARK, WENZEL.
141. **Oral Interpretation.** Oral reading for understanding, appreciation, and communication. 3 hours.
142. **Group Oral Interpretation of Literature.** The study of modern modes of group presentation of literature with emphasis on practice in script preparation, directing, and performance in Chamber Theatre and Readers Theatre. Prerequisite: Speech 141 or consent of instructor. 2 hours.
157. **Elements of Stagecraft.** Same as Theatre 120. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
161. **Fundamentals of Acting.** Same as Theatre 170. A study of the methods of acting, with emphasis given to basic techniques. The role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretation by means of voice and action. 3 hours. AHART, ARBENZ.
175. **A Survey of Historical and Professional Aspects of Speech Pathology and Audiology.** A survey of the fields of speech pathology and audiology, with emphasis on historical and philosophical developments, relations to other professions, professional practice, and function and role in study of human communication. Prerequisite: Sophomore standing. 2 hours. O'NEILL. and others.
177. **The Arts of Public Discourse.** The nature and forms of practical and artistic public speech, including adaptations for the mass audience. 4 hours.
178. **The Arts of the Theatre and Interpretative Speech.** The nature and forms of perform-

ing speech arts of theatre, interpretation, and film, including adaptations for the mass audience. 4 hours.

198. **Freshman Seminar.** Survey of the role of the screen media in contemporary American culture. Discussions, reports, and papers on topics of individual concern. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours. MUELLER.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Empirical Studies in Speech Communication.** A survey of quantitative studies in speech communications; limited study of research methodologies; emphasis on findings relevant to speaker, audience, and message variables in public speaking and group discussion situations. 3 hours.
203. **Dramatics for Teachers.** A survey of methods and procedures of play production in the secondary school. 3 hours.
204. **Speech for Teachers.** A course in teaching methods designed for prospective teachers who are non-speech majors. A discussion of methods and materials available for teaching speech and directing extracurricular speech activities. 3 hours. INCE.
207. **The Art of the Screen: Humor.** A study of selected comedies and other specimens of film and television humor in relation to theories of humor. Prerequisite: Consent of instructor. 3 hours. MUELLER.
208. **Speech and Hearing Problems in the Classroom.** An orientation of prospective teachers to speech and hearing problems encountered in the elementary and secondary schools with emphasis on description of problems and types of classroom management. Prerequisite: Junior standing. 3 hours. ERICKSON.
211. **Business and Professional Speaking.** Study, preparation, and presentation of the chief types of business speeches, with special attention to conferences, sales talks, interviews, and job applications. Prerequisite: Speech 101. 2 hours.
213. **Persuasion and the Arts.** An introduction to the study of narrative films, theatre, fiction, and poetry as vehicles of indirect and overt persuasion. 3 hours. THOMAS.
221. **Advanced Public Speaking: The Psychological Bases of Discourse.** Study of the processes of motivation as applied to speeches intended to influence group opinion and action; practice in the preparation and delivery of short persuasive speeches. Prerequisite: Speech 101; junior standing. 3 hours. BROADRICK, NICHOLS.
243. **The Oral Interpretation of Shakespeare.** Analysis and oral presentation of selections from Shakespeare's plays. Prerequisite: Junior standing; Speech 141. 2 hours. MACLAY.
247. **Teaching of Speech.** Same as Secondary and Continuing Education 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours. INCE.
248. **Speech Correction Methods in the Schools.** Same as Elementary Education 248. A study of methods and materials used by the school speech correctionist. Prerequisite: Speech 388. 3 hours. JOHNSON.
255. **Directing, I.** Same as Theatre 281. Problems of script selection and interpretation, casting, rehearsing, and performances. Techniques of composition, movement, and business for the proscenium stage. Direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Radio and Television 280, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.
291. **Honors Course.** Individual study leading either to a thesis or to a comprehensive examination for honors in the Department of Speech. Prerequisite: Senior standing; a grade-point average of 4.0 or consent of head of department. 2 hours. This course may be repeated for a maximum of 4 hours credit.

293. **Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of speech; grade-point average of 3.75; consent of head of department. 2 hours. This course may be repeated for a maximum of 4 hours credit.
301. **General Phonetics.** Basic principles of phonetic study, including observation and representation of pronunciation; ear training; practice in transcription. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit. PADEN.
307. **The Art of the Screen: Narration.** Same as Communications 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or 1/2 or 1 unit. MUELLER.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Communications 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Speech 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or 1/2 or 1 unit. MUELLER.
311. **British Public Address.** A study of representative British speakers and speeches from earliest times to the present. Prerequisite: Junior standing. 3 hours, or 1/2 or 1 unit.
312. **American Public Address.** Study of representative American speeches from the sixteenth century to the present. 3 hours, or 1/2 or 1 unit. BROADRICK, NICHOLS.
313. **Interpersonal Communication: Discussion and Interview.** Advanced study of theory, research, techniques, and training methods in interviewing and group discussion. Emphasis is on empirical research findings concerning communication processes in face-to-face groups. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 or 1 unit. DELIA.
319. **Russian and East European Cinema.** Same as Communication, Humanities, and Slavic 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or 3/4 unit.
320. **Theory of Argumentation.** Study of the philosophical, logical, and psychological bases of argumentation and their implications for public and educational debate and discussion. Prerequisite: Speech 121 or consent of instructor. 3 hours, or 1/2 or 1 unit. WENZEL.
321. **Theories of Persuasion and Rhetorical Practice.** A survey of theories of persuasion derived from rhetorical, philosophical, and psychological sources and their application to persuasive discourse. Prerequisite: Junior standing or consent of instructor. 3 hours, or 1/2 or 1 unit. ANDERSEN, CLARK.
322. **Modern Rhetorical Theory.** Significant movements in the development of rhetorical theory in England, France, and America from 1700 to the present. Prerequisite: Senior standing. 3 hours, or 1/2 or 1 unit. NICHOLS.
323. **Rhetorical Criticism.** Methods of interpreting and judging persuasive discourse with emphasis on political speaking and writing. Lectures and practice in criticism. Prerequisite: Credit or registration in Speech 311, 312, or 322. 3 hours, or 1/2 or 1 unit. NICHOLS.
325. **Rhetorical Theory in the English Renaissance.** A study of the principles of rhetoric in England from 1500 to 1700, including their application to selected literature and speeches of the period. 3 hours, or 1/2 or 1 unit.
333. **Style and Delivery.** A study of verbal and nonverbal features of communicative and expressive utterance. Prerequisite: A sophomore course in written or spoken composition, and junior standing; or consent of instructor. 3 hours, or 1/2 or 1 unit.
342. **Oral Interpretation of Poetry.** Analysis and oral presentation of literature representative of various poetic forms. Prerequisite: Speech 141. 3 hours, or 1/2 or 1 unit. BURNS, MACLAY.

- 344. Criticism of the Oral Interpretation of Literature.** An examination of theories of aesthetics and practical criticism and their application to the criticism of specific examples of the oral performance of literature. Prerequisite: Speech 141, graduate standing, or consent of instructor. 3 hours, or 1/2 or 1 unit.
- 345. Contemporary Approaches to Oral Interpretation.** Modern concepts underlying the relationship of interpretation to the reader's experience of literature; discussions, reports, and oral interpretations of prose forms (including Chamber Theatre and Readers Theatre). Prerequisite: Speech 141 or consent of instructor. 3 hours, or 1/2 or 1 unit. MACLAY.
- 346. Introduction to Folklore: History, Theory, Methods.** Same as Comparative Literature, English, German, and Slavic 394. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or 3/4 unit.
- 352. Introduction to Modern Theatre Art.** Same as Theatre 352. Origins and development of modern theatrical production; a critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit. HEWITT.
- 361. History of the European Theatre to the Renaissance.** Same as Theatre 361. The theatre and the theatre arts of ancient and of medieval Europe. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit. SCOTT.
- 362. History of the European Theatre from the Renaissance to 1900.** Same as Theatre 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit. BEHRINGER, SCOTT.
- 363. Advanced Dramatic Writing.** Same as Radio and Television 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Speech 263 or Theatre 280; consent of instructor. 3 hours, or 1/2 or 1 unit. This course may be repeated for a maximum of 6 hours or 2 units of credit.
- 366. Development of the American Theatre.** Same as Theatre 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit. HEWITT.
- 371. History and Principles of Literary and Rhetorical Criticism.** Same as English 371. Aristotle to Sidney. Prerequisite: Senior standing. 3 hours, or 1/2 or 1 unit.
- 372. History and Principles of Literary and Rhetorical Criticism.** Same as English 372. Sidney to the present. Prerequisite: Senior standing. 3 hours, or 1/2 or 1 unit.
- 375. Speech Science, I.** Same as Linguistics 375. An introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, and to fundamental acoustics of speech. Prerequisite: Speech 109, or 301, or consent of instructor. 4 hours or 1 unit. ZEMLIN.
- 376. Speech Science, II.** Same as Linguistics 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Speech 375. 4 hours or 1 unit. ZEMLIN.
- 377. The Bases of Speech and Hearing Science.** An introduction the anatomical and physiological characteristics of the normal speech and hearing mechanisms, the acoustical characteristics of speech, and the hearing of speech. Not open to students with credit in Speech 375 or 376. Prerequisite: Speech 109 or equivalent; consent of instructor. 3 hours or 1/2 unit.
- 378. Hearing Science.** Acoustics, anatomy, and physiology of the auditory system, psychophysical methods, and a consideration of auditory theories and mechanics. Prerequisite: Speech 375. 3 hours or 1/2 unit.

383. **Development of Spoken Language.** A study of the correlates of language development from the prelinguistic period to adulthood. Prerequisite: Senior standing; consent of instructor. 3 hours, or 1/2 or 1 unit.
385. **Speech Pathology, I.** A study of the causes, symptoms, and treatment of speech disorders, including articulatory, vocal, and rhythmical disorders. Observation of clinical techniques is required. Prerequisite: Ten hours of speech, including Speech 109; credit or registration in Speech 375 or consent of instructor. 3 hours or 1/2 unit. SIMPSON.
386. **Basic Diagnostic and Therapeutic Principles of Speech Correction.** Instruction and practice in the administration and interpretation of diagnostic tests; discussion and demonstration of clinical approaches used with speech disorders. Prerequisite: Speech 385, 388, or registration in Speech 388. 3 hours or 1/2 unit.
387. **Practicum in Speech Diagnosis and Therapy.** Observation, practice, and research in diagnosis and therapy of speech disorders. Students may repeat either Speech 387 or 398, but not both, for three credit hours. Prerequisite: Speech 386 and 389; a grade-point average of at least 3.5; consent of instructor. 3 hours or 1/2 unit.
388. **Speech Pathology, II.** A study of causes, symptoms, and treatment of speech disorders, including stuttering, cerebral palsy, aphasia, and cleft palate. Prerequisite: Speech 385. 3 hours, or 1/2 or 1 unit. SIMPSON.
389. **Psychological Appraisal in Speech Pathology and Audiology.** An introduction to principles of diagnostic testing, discussion of administration, scoring, and interpretation of tests used to supplement data obtained during speech, language, and hearing evaluation. Prerequisite: Speech 383 and 385, a course in tests and measurement, or consent of instructor. 3 hours or 1/2 unit. DEMARCO.
390. **Communication Disorders in Children: Habilitation and Rehabilitation.** Principles of differential diagnosis, therapeutic diagnosis, clinical and classroom habilitation and rehabilitation of children with communicative disorders etiologically associated with neurological impairment, emotional disturbance, environmental deprivation, bilingualism, and mental retardation. Prerequisite: Speech 383; senior or graduate standing or consent of instructor. 3 hours, or 1/2 or 1 unit.
391. **Introduction to Hearing Disorders.** Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; principles of retraining the hard-of-hearing. Prerequisite: Speech 375 and 378, or consent of instructor. 3 hours or 1/2 unit. STARK.
392. **Seminar in Development and Measurement of Spoken Language.** A review of the research and practical methodology associated with the development and measurement of spoken language. Prerequisite: Speech 383 or consent of instructor. 3 hours or 1 unit.
393. **Aural Rehabilitation.** Principles and methods of clinical and classroom retraining of the hard-of-hearing, including lip reading, auditory training, speech correction and conservation, and counseling. Required in curriculum of teacher training in speech correction. Prerequisite: Speech 391; grade-point average of 3.5; consent of instructor. 3 hours, or 1/2 or 1 unit. NASCA.
394. **Hearing Conservation.** A survey of auditory screening methods, educational and protective measures, and follow-up procedures utilized in public health, public school, and college, military, and industrial settings. Prerequisite: Speech 391 and 395. 3 hours, or 1/2 or 1 unit. O'NEILL.
395. **Audiometry.** Principles and application of basic audiometry. Prerequisite: Speech 391 or consent of instructor. 3 hours, or 1/2 or 1 unit. STARK.
396. **Diagnosis of Hearing Impairments in Infants and Young Children.** Symptoms and causes of hearing impairment in young children; practice in procedures used for the measurement of residual hearing; the selection and use of hearing aids. Prerequisite: Speech 391, 395, or consent of instructor. 3 hours, or 1/2 or 1 unit. STARK.
397. **Measurement of Auditory Perception.** Principles and methods of clinical assessment of auditory perception. Intensive study of measurement techniques for speech perception;

applications with clinical clients; survey of current literature and research. Prerequisite: Speech 391 and 395. 3 hours, or 1/2 or 1 unit. O'NEILL, STARK.

- 398. Practicum in Audiology.** Observation, practice, and research in diagnosis and rehabilitation of auditory disorders. Students may repeat either Speech 398 or 387, but not both, for three credit hours. Prerequisite: Speech 389 and 393. 3 hours or 1/2 unit. ERICKSON, NASCA, STARK.
- 399. Design and Analysis of Experiments in Speech and Hearing Science.** An introduction to experimental designs and methods of statistical analysis in speech and hearing research. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit. DEMARCO.
- 400. Seminar in Dramatic Form and Structure.** Same as Theatre 400. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Theatre 361 and 362, or equivalent; consent of instructor. 1 unit.
- 403. Seminar for Teachers of Speech.** Investigation of current principles, materials, and developments in the field of speech and of their relationship to the teacher. 1 unit. BURNS.
- 411. The Greek Tradition in Rhetoric and Oratory.** The development of the Greek tradition in rhetorical theory, practice, criticism, and pedagogy from Homer to the Renaissance; analysis of the contribution of major figures and works to that tradition. 1 unit.
- 412. The Roman Tradition in Rhetoric and Oratory.** Development of the Roman tradition in rhetorical thought and practice from Cicero through the English Renaissance. 1 unit.
- 420. Quantitative Methods in Rhetorical Analysis.** An introduction to the principles, procedures, and tools of research used in the quantitative analysis of the oral communication situation, including the experimental designs and statistical methods applicable to rhetorical analysis, and the identification, control, and measurement of rhetorical variables. Students participate in planning, executing, and reporting a limited experimental project investigating some oral communication variable. Prerequisite: Introductory course in statistics; consent of instructor. 1 unit. Offered in 1972-1973 and in alternate years.
- 423. The Rhetoric of Aristotle.** Study of the Rhetoric in relation to other works of Aristotle. 1 unit.
- 430. Contemporary Theories of Oral Communication.** Systematic study of speech-making and discussion as related to contemporary views of communication; examination of the theoretical literature and experimental evidence. Prerequisite: Consent of instructor. 1 unit.
- 436. Seminar in Theories and Procedures of Discussion.** Investigation of the history, structure, and dynamics of dialectical forms of speech such as dialogue, panel, forum, debate, and parliamentary practices, with consideration of ethics, freedom of speech, and the forming of public opinion. 1 unit.
- 438. Seminar in Rhetorical Theory.** Study of special topics in the history of rhetorical theory. 1 unit. May be repeated for a maximum of 4 units.
- 441. Historical Background of Oral Interpretation.** Historical survey of British and American theories of interpretation. 1 unit.
- 442. Seminar in Oral Interpretation.** Investigation of basic problems in the history, nature, and function of oral interpretation. Prerequisite: Speech 441; consent of instructor. 1 unit.
- 443. Seminar in the Oral Interpretation of Individual Literary Style.** Examination of the literary style of an individual writer or selected writers, through research, discussion, and oral readings; subject announced each semester. Prerequisite: Speech 344. 1 unit. May be repeated for a maximum of 2 units.
- 451. Problems in Play Directing in the Educational Theatre.** Same as Theatre 451. Study of the audience, play selection, the actor's abilities and needs, tryouts and casting, conduct or rehearsals and methods of directing, the dramatic club, contests and festivals. 1 unit. BEHRINGER.

452. **Problems in Play Production in the Educational Theatre.** Same as Theatre 452. Study of the school auditoria and stages, stage machinery and equipment and their use, lighting facilities and their use, organization of backstage crews, scene shifting and stage management, production problems of special types of plays. 1 unit. BEHRINGER.
461. **Advanced Theatre Techniques.** Same as Theatre 461. Individual development of advanced techniques of acting and staging through supervised participation in public productions. Prerequisite: At least one semester of graduate study in the area of theatre; consent of head of department and of instructor. 1/2 or 1 unit.
463. **Seminar in the History of Acting.** Same as Theatre 463. Studies in the history and theory of the art of acting. Prerequisite: Consent of instructor. 1 unit. Students may accumulate maximum credit of 2 units. Offered in 1973-1974 and in alternate years.
465. **Seminar in Theatre Art.** Same as Theatre 465. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit. HEWITT.
466. **The American Theatre Since 1900.** Same as Theatre 466. Major developments in acting, production, playwriting, organization, and operation. Prerequisite: Consent of instructor. 1 unit. BEHRINGER.
468. **Seminar in Theatre History.** Same as Theatre 468. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit. HEWITT.
469. **The Stage History of Classic English Plays.** Same as Theatre and English 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit. SHATTUCK.
472. **Psychoacoustics of Speech.** Theory and principles of auditory perception of speech; survey of experimental and theoretical literature; laboratory demonstration and experimentation. Prerequisite: Speech 375, 376, 391, or consent of instructor. 1 unit. O'NEILL.
475. **Experimental Phonetics, I.** Same as Linguistics 475. Theoretical consideration of speech as motor behavior, with special reference to physiological investigations of normal respiration, phonation, and articulation. Survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit. ZEMLIN.
476. **Experimental Phonetics, II.** Same as Linguistics 476. Theoretical consideration of speech as an acoustical phenomenon, with special reference to acoustical investigations of voice and speech sounds. Survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit. ZEMLIN.
477. **Measurement of Speech, I.** Same as Linguistics 477. Principles and methods of measuring speech action. Special action recorders and transducers; techniques of analysis; problems of experimental design. Laboratory experimentation. Prerequisite: Consent of instructor; credit or registration in Speech 475. 1 unit. ZEMLIN.
478. **Measurement of Speech, II.** Same as Linguistics 478. Principles and methods of measuring the acoustical phenomena of speech. Oscillographic measurement of vocal variables; special instruments and media for automation graphic recording; analysis of data; problems of experimental design. Laboratory experimentation. Prerequisite: Consent of instructor; credit or registration in Speech 476. 1 unit. ZEMLIN.
481. **Seminar in Neuropathologies of Speech and Language.** Advanced study of speech, vocal, and linguistics problems associated with cerebral palsy and aphasia. The following topics are offered in rotation, one or two each semester: neurological aspects, aphasia, cerebral palsy. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 3 units.
482. **Seminar in Stuttering.** Principles, theories, and methods of clinical management of stuttering behavior in children and adults. Prerequisite: Speech 388. 1 unit.
483. **Psychology of Speech and Hearing Disorders, I.** Same as Psychology 483. A survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to speech disorders. Review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit. O'NEILL.

- 484. Psychology of Speech and Hearing Disorders, II.** Same as Psychology 484. A survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders. Review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit. O'NEILL.
- 486. Advanced Clinical Techniques in Speech and Hearing.** Semi-independent management of complex cases; participation in examination and analysis. The following topics are offered each semester: theory of clinical practice, speech pathology, audiology, language disorders, field study. Prerequisite: Consent of instructor. 1/2 to 4 units.
- 488. Diagnostic Procedures in Pathologies of Speech and Language.** Study of diagnostic procedures used in the analysis of neuropathologies of speech and language and orofacial and laryngeal pathologies of speech. Prerequisite: Consent of instructor. 1 unit.
- 489. Seminar in Orofacial and Laryngeal Pathologies of Speech.** Advanced study in speech and vocal problems associated with cleft palate, laryngeal dysfunctions, and facio-maxillary disturbances. The following topics are offered in rotation, one each semester: cleft palate, organic vocal problems. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
- 490. Medical Aspects of Speech Disorders and Audiology.** Study of acute and chronic hearing and speech disorders traceable to disease of the ear and vocal mechanisms in relation to the techniques and philosophies utilized in a medically oriented environment. Prerequisite: Speech 385, 388, and 486. 1 unit. O'NEILL.
- 491. Seminar in Hearing Disorders.** Principles and methods of clinical management of all types of hearing disorders. Survey of current literature and research. The following topics are offered in rotation, one or two each semester: automatic audiometry, aural rehabilitation, hearing aids and amplification. Prerequisite: Speech 391. 1 unit. May be repeated for maximum of three units.
- 492. Advanced Audiology.** Advanced study of rationale and development of principles associated with special techniques, procedures, and methods used in audiology. Prerequisite: Speech 395 and 397. 1 unit. STARK.
- 495. Special Problems.** Individual investigation of special projects not included in theses. Prerequisite: Consent of head of department. 1 to 2 units. Open to master's candidates for 1 unit, to doctor's candidates for 1 or 2 units.
- 499. Thesis Research.** 0 to 4 units. ANDERSEN, BATEMAN, BEHRINGER, BROADRICK, BURNS, CLARK, HEWITT, INCE, KIM, LOCKE, MACLAY, NEBERGALL, NICHOLS, O'NEILL, SCOTT, SHATTUCK, STARK, WENZEL, ZEMLIN.

Swahili

(See Linguistics)

THEATRE

Chairman of Department: Professor B. HEWITT

Department Office: 4-122 Krannert Center for the Performing Arts

- 100. Practicum, I.** Laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting, sound properties, costumes, and makeup for public performance. Prerequisite: Consent of instructor for non-theatre majors. 1 to 3 hours. May be repeated for three semesters.
- 101. Theatre: Modern Forms.** Introduction to theatre aesthetics, to theatre as a profession, and to the theatre plant; study of dramatic form and structure with emphasis on realism, naturalism, and their modifications. Survey of theatre history from 1850 to World War II. 4 hours.

102. **Theatre: Contemporary Forms.** A study of revolts against realism; includes symbolism and its theatre, theories of Appia and Craig, expressionist drama and its staging, Brecht and epic theatre, theatre of the absurd and later developments and the musical play. Prerequisite: Theatre 101. 3 hours.
103. **Theatre: Classical and Medieval Forms.** Theatre architecture, drama, and play production practices of ancient Greece and Rome, of Asia, and of Britain and the Continent during the Middle Ages. Prerequisite: Theatre 101. 3 hours.
104. **Theatre: Sixteenth- and Seventeenth-Century Forms.** A survey of theatre history and drama with emphasis on Baroque Spain, Elizabethan England, and Renaissance Italy. Prerequisite: Theatre 101. 3 hours.
105. **Theatre: Seventeenth- and Eighteenth-Century Forms.** Survey of theatre history and drama with emphasis on France of the Neoclassical era, England of the Restoration, and Europe and America of the Georgian period. Prerequisite: Theatre 101. 3 hours.
111. **Materials and Processes: Textiles.** A study of fibers, weaving methods, and color application. Laboratory projects used to demonstrate textiles' response to cutting, draping, and suitability for stage scenery, properties, and costumes. 2 hours.
112. **Materials and Processes: Woods and Metals.** A study of the properties, availability, and costs of the woods and metals most useful for the theatre. Laboratory experience in cutting, jointing, shaping, and finishing. 2 hours.
113. **Materials and Processes: Papers and Plastics.** Exploration of the potential use for a broad range of papers and plastics in the construction of stage properties, decoration, and accessories. 2 hours.
120. **Elements of Stagecraft.** Same as Speech 157. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
121. **Scenecraft.** Introduction to theatre shop organization, tools, and materials. Basic scenery construction, painting, and assembling. Open to students in the College of Fine and Applied Arts only. 2 hours.
131. **Stage Lighting and Sound Effects.** The history and development of stage lighting; the theory and function of stage lighting and sound, examination of instruments, equipment, and installations; planning the design of stage lighting and sound. Lectures, practical problems, and laboratory. 3 hours.
140. **Costume Construction.** Theory and practical techniques of sewing, fitting, and decorating stage costumes analyzed and applied to specific production situations. Laboratory practice culminating in construction of a period costume by each student. 2 hours.
141. **Makeup for the Theatre, I.** Principles, materials, equipment, and application techniques. Corrective and age effects; delineation of character through use of paint and hair goods. Lecture, discussion, and practice. 2 hours.
142. **Makeup for the Theatre, II.** Equipment and methods for creation of three-dimensional effects through use of putty, wax, adhesives, and rubber. Techniques of design and execution of masks, national types, and non-realistic styles. Lecture, demonstration, and practice. Prerequisite: Theatre 141. 2 hours.
170. **Fundamentals of Acting.** Same as Speech 161. A study of the methods of acting, with emphasis given to the basic stage techniques. The role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretations by means of voice and action. 3 hours.
171. **Speech for the Stage: Fundamentals.** A study of the physical and psychological bases of speech and the analysis and synthesis of speech sounds. Training in the requirements of good voice in the theatre; projection through breath control, support of tone, resonance, voice placement, articulation, and the element of tone. Exercises in elimination of speech regionalisms. 2 hours.
172. **Speech for the Stage: Dialogue.** Examination of the dialogue in modern plays, primarily British and American; analysis of its construction, characteristics, thought, and emotion; making meaning clear through phrasing; attainment of vitality and variety. Class practice and performance. Prerequisite: Theatre 171. 2 hours.

173. **Speech for the Stage: Dialects.** Analysis of British stage speech and the important departures from it and of the major dialects in the United States; their phonetic transcription. Training in perception; the use of dialects in plays. Exercises and practice. Prerequisite: Theatre 172. 2 hours.
174. **Movement for the Stage: Improvisation.** Purposes and history; exercises in developing the sense memories and in their pantomimic recall; exercises to heighten the actor's observations, imagination, and creative powers. Characterized pantomime, both improvised and based on characters in plays. 2 hours.
175. **Movement for the Stage: Techniques.** Use of movement in acting; physiological and psychological bases of movement; analysis and synthesis of the body's movement; movement timing, spacing, force, quality, climax, motivation; stage conventions in movement; movement and character. Exercises and drill. Prerequisite: Theatre 174. 2 hours.
176. **Acting: Characterization.** Analysis of characters in modern plays. Examination of external factors; critical comment on plays. Author's comments and descriptions. Analysis of internal signposts pointing to definition of character. Embodiment of traits in performance. Prerequisite: Theatre 175. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **Advanced Scenecraft.** The examination of stage equipment, including rigging systems, revolves and wagon systems, platforming, and methods of shifting stage scenery. Prerequisite: Theatre 121. 2 hours.
221. **Advanced Scenery Painting.** Studio course in the problems of painting stage scenery, with special emphasis on contemporary materials and rendering processes. Prerequisite: Theatre 220 or consent of instructor. 2 hours.
222. **Scene Design, I.** Introduction to the basic processes of designing for the stage, including physical considerations, relevant research for design, stage perspective, and specific design projects for proscenium and open stage forms. Prerequisites: Theatre 220 or consent of instructor. 3 hours.
231. **Stage Lighting Design.** A studio course analyzing current lighting practices by means of production-oriented projects. Prerequisite: Theatre 131. 3 hours.
241. **Costume Design.** Application of design elements to creation and analysis of costume designs. Evaluation of sketches on the basis of aesthetic and practical criteria. Emphasis on function of costume as an element in unified production. Prerequisite: Theatre 140. 3 hours.
242. **Costume Accessories.** Materials and methods for fabricating and renovating period costume accessories. Analysis in terms of cost, labor, and effectiveness on stage. Laboratory projects for development of skills in handling materials and processes. Projects to include construction of armor, jewelry, wigs, and small properties. Prerequisite: Theatre 140. 2 hours.
263. **Theatre of the Black Experience.** An aesthetic approach to the study of Afro-American drama concerned with the principles, playwrights, movements, and media of Black drama since 1960. Prerequisite: Consent of instructor. 3 hours.
271. **Acting: Studio, I.** Periodic performances of soliloquies and short scenes from plays written after World War I. Presentation before members of the theatre faculty and invited guests. Prerequisite: Second semester junior standing in the acting option or consent of the theatre faculty. 3 hours.
272. **Acting: Styles for Period Plays.** Acting in important theatrical periods: Classical Greece, the *commedia dell'arte* of Italy, Elizabethan England, the Carolinian Restoration, seventeenth-century France, nineteenth-century Europe and America. The effect on acting of the theatre's physical aspects. Class performance of scenes. Prerequisite: Theatre 170 or 176. 3 hours.
280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric and Speech 263, and Radio and Television 280. A study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.

281. **Directing, I.** Same as Speech 255. Problems of script selection and interpretation, casting, rehearsing, and performances. Techniques of composition, movement, and business for the proscenium stage. Direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
291. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
292. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
300. **Practicum, II.** Advanced laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting sound, properties, costumes, and makeup for public performance. Prerequisite: For non-theatre majors consent of instructor. 1 to 3 hours, or 1/4 to 1/2 unit. May be repeated to a total of 12 hours or 2 units.
310. **Theatre Planning and Programming.** Theatre programming including consideration of relationships of audience to stage, the merits of the various stage technological systems, and the related business, audience, and production facilities of a theatre center. 2 hours or 1/2 unit.
320. **Scene Design, II.** Studio course with design projects for period plays, the musical theatre, and contemporary forms. Prerequisite: Theatre 222, or consent of instructor. 3 hours or 1/2 unit.
330. **Photo-Projection Techniques.** Integration of film techniques with the scenic environment for modern staging, including initial rendering, film processing, projection surfaces, and stage projection equipment. Prerequisite: Theatre 131. 2 hours or 1/2 unit.
352. **Introduction to Modern Theatre Art.** Same as Speech 352. Origins and development of modern theatrical production; a critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
353. **Creative Dramatics for Children.** A study of the subject matter and techniques of creative dramatics for children with laboratory application. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
354. **Theatre for the Child Audience.** A study of the history, objectives, and techniques of play production for the child audience, with laboratory application. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
361. **History of the European Theatre to the Renaissance.** Same as Speech 361. The theatre and the theatre arts of ancient and of medieval Europe. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
362. **History of the European Theatre from the Renaissance to 1900.** Same as Speech 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
366. **Development of the American Theatre.** Same as Speech 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. Prerequisite: Consent of instructor. 3 hours, or 1/2 or 1 unit.
368. **History of Theatre Costume.** A survey of the history of costumes worn on the stage from the classical Greek period to the present. Prerequisite: Theatre 361 and 362, or consent of instructor. 3 hours, or 1/2 or 1 unit.
371. **Acting: Studio, II.** Public presentation of short scenes under semi-production conditions: basic lighting, stock costumes, minimal properties. Prerequisite: Second semester senior standing in the acting option or consent of theatre faculty. 3 hours or 1/2 unit.
372. **Acting: Theories.** Summary of acting theories prior to the nineteenth century. Intensive examination of philosophies, theories, and principles promulgated by teachers, playwrights, critics, and actors, ranging from Delsarte and the early romanticists, realists and naturalists, to the present-day absurdists. 3 hours, or 1/2 or 1 unit.
380. **Advanced Dramatic Writing.** Same as Radio and Television 363 and Speech 363. Application of principles of dramatic form and structure to the more complex problems

of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Theatre 280; consent of instructor. 3 hours, or 1/2 or 1 unit. Students may accumulate 6 hours or 2 units of credit.

381. **Directing, II.** Production problems and techniques of movement and business for non-proscenium staging areas. Direction of appropriate scenes for class presentation; study of production practices for the musical play. Prerequisite: Theatre 281. 3 hours or 1/2 unit.
400. **Seminar in Dramatic Form and Structure.** Same as Speech 400. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Theatre 361 and 362, or equivalent; consent of instructor. 1 unit.
451. **Problems in Play Directing in the Educational Theatre.** Same as Speech 451. Study of the audience, play selection, the actor's abilities and needs, tryouts and casting, conduct of rehearsal and methods of directing, the dramatic club, contests and festivals. 1 unit.
452. **Problems in Play Production in the Educational Theatre.** Same as Speech 452. Study of the school auditoria and stages, stage machinery and equipment and their use, lighting facilities and their use, organization of backstage crews, scene shifting and stage management, production problems of special types of plays. 1 unit.
461. **Advanced Theatre Techniques.** Same as Speech 461. Individual development of advanced techniques of acting and staging through supervised participation in public productions. Prerequisite: At least one semester of graduate study in the area of theatre; consent of head of department and of instructor. 1/2 or 1 unit.
463. **Seminar in the History of Acting.** Same as Speech 463. Studies in the history and theory of the art of acting. Prerequisite: Consent of instructor. 1 unit. Students may accumulate maximum credit of 2 units. Offered in 1973-1974 and in alternate years.
465. **Seminar in Theatre Art.** Same as Speech 465. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit.
466. **The American Theatre Since 1900.** Same as Speech 466. Major developments in acting, production, playwriting, organization, and operation. Prerequisite: Consent of instructor. 1 unit.
468. **Seminar in Theatre History.** Same as Speech 468. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit.
469. **The Stage History of Classic English Plays.** Same as speech and English 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit.
491. **Special Problems.** Same as Speech 495. Individual research in selected topics by arrangement with the instructor. 1/2 to 2 units.
499. **Thesis Research.** 0 to 2 units.

THEORETICAL AND APPLIED MECHANICS

Head of Department: Professor R. T. SHIELD

Department Office: 212 Talbot Laboratory

150. **Analytical Mechanics (Statics).** Resultants of force systems; algebraic and graphical conditions of equilibrium of force systems; analysis of forces acting on members of trusses, frames, etc.; forces due to friction; centroids. Prerequisite: Physics 101 or 106, or Liberal Arts and Sciences 141; registration in Mathematics 140, 141, or 145. 2 hours.
152. **Engineering Mechanics, I (Statics).** Analysis of force systems by means of vector algebra. Two- and three-dimensional systems, including force fields, are treated. The princi-

ple of virtual work is introduced. Prerequisite: Physics 106; registration in Mathematics 140, 141, or 145. 3 hours.

154. **Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 211 with less emphasis on some topics. Prerequisite: Physics 101 or 106; registration in Mathematics 140, 141, or 145. 4 hours.
156. **Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 211. Prerequisite: Physics 101 or 106; registration in Mathematics 140, 141, or 145. 5 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
211. **Analytical Mechanics (Dynamics).** Displacement, velocity, and acceleration of a particle; relation between forces acting on rigid bodies and the changes in motion produced; translation; rotation; plane motion; solutions using the principles of force, mass and acceleration, work and energy, and impulse and momentum. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
212. **Engineering Mechanics, II (Dynamics).** Introduces the elements of vector calculus as applied to mechanics; treats kinematics, moving reference frames, and Coriolis accelerations; treats the kinetics of central force motion and plane motion; introduces energy and momentum principles for particles and rigid bodies and presents the notion of the inertia tensor and Euler's equations of motion. Prerequisite: Physics 106; Theoretical and Applied Mechanics 152; Mathematics 141. 3 hours.
221. **Elementary Mechanics of Deformable Bodies.** Elastic and inelastic relationships between external forces (loads) acting on deformable bodies and the stresses and deformations produced; tension and compression members; members subjected to torsion and to bending; buckling (columns); combined stresses; repeated loads (fatigue); energy loads, impact; influence of properties of materials. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
223. **Mechanical Behavior of Solids.** Influence of loading conditions and environment on the behavior of engineering materials; effects of rate of loading, time, temperature, number of stress cycles, and state of stress on the ductile and brittle behavior of materials; significance of mechanical properties. Prerequisite: Registration in Theoretical and Applied Mechanics 221. 1 hour.
224. **Behavior of Materials.** Introduction to atomic and molecular structure of metals, cement, concrete, plastics, ceramics, and glass. Response of these materials to rapid, steady, and repeated loads at various temperatures (and environments) in terms of rheological models; fracture behavior of specific materials, i.e., stress rupture, brittle fracture, and fatigue of metals and concrete. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
235. **Fluid Mechanics.** Fluid properties, statics, fluid flow, ideal and real fluids, similitude, laminar and turbulent flow in closed conduits, boundary layers, free surface flow, turbo machinery. Prerequisite: Theoretical and Applied Mechanics 211 or 212. 4 hours
293. **Senior Research Project.** Students work briefly in each of the several areas of modern research in theoretical and applied mechanics. After selecting one area for further study, each student prepares a proposal for a research project which will be carried out in Theoretical and Applied Mechanics 294. Prerequisite: Senior standing in engineering mechanics. 2 hours.
294. **Senior Research Project.** Individual projects in the field of mechanics previously selected in Theoretical and Applied Mechanics 293 are conducted. Each student prepares a technical report or paper, and presents the results orally. The best papers are presented at a symposium held at the end of the semester and are bound together and published as a theoretical and applied mechanics report. Prerequisite: Theoretical and Applied Mechanics 293. 4 hours.
299. **Thesis.** Thesis investigation of special subjects including theoretical and/or experimental research. Prerequisite: Senior standing; approval of head of department. 3 hours.
311. **Mechanical Vibrations.** Kinematics of vibratory motion; comprehensive study of motion having single degree of freedom; critical speeds of shafts; vibration of systems with

several degrees of freedom. Applications to engineering problems. Credit is not given for both Theoretical and Applied Mechanics 311 and Civil Engineering 374. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or 211 or 212, and 221. 3 hours, or 1/2 to 1 unit.

314. **Advanced Dynamics for Engineers.** Three-dimensional kinematics of a rigid body; general dynamics of a rigid body, moments and products of inertia, kinetic energy, rotation of a rigid body about a fixed axis and about a fixed point. Euler equations of motion, gyroscopic theory; introduction to Lagrange equations; engineering applications. Prerequisite: Theoretical and Applied Mechanics 211 or equivalent; Mathematics 341 or 345. 3 hours or 1 unit.
315. **Advanced Dynamics with Applications to Engineering Problems.** General advanced methods of dynamics are discussed. Some emphasis is placed on the behavior of special components of guidance and control systems. Associated engineering problems are treated. Topics: Lagrange equations and Hamiltonian canonical equations, Hamiltonian methods; theory of vibrations; special theory of relativity, gyroscopic compass; gyroscopic stabilizer; modern gyroscopes; astronomical applications. Prerequisite: Theoretical and Applied Mechanics 314 or equivalent. 3 hours or 1 unit.
321. **Advanced Mechanics of Deformable Bodies.** Basic concepts of mechanics of deformable bodies and brief review of elementary topics; theory of stress and strain at a point; theories of failure, including failure by fracture; unsymmetrical bending; curved beams; torsion of non-circular sections; energy principles; Castigliano's theorem. Prerequisite: Theoretical and Applied Mechanics 211 and 223 or 224. 3 hours, or 1/2 to 1 unit.
324. **Flow and Fracture of Structural Metals.** Fundamental concept of strength of crystalline engineering materials at atomic, single crystal, and polycrystalline levels of association in relation to engineering mechanisms of failure. Functional relationship between material variables, state of stress, strain, time, temperature, and failure of engineering components by creep, stress rupture fatigue, and brittle fracture. Prerequisite: Theoretical and Applied Mechanics 221 and 224 or consent of instructor. 3 hours or 3/4 unit.
326. **Experimental Stress Analysis.** Measurement of stresses or deformations that are of significance in the engineering design of load resisting members; use of optical, electrical, and mechanical instrumentation, models, analogies, brittle coatings, electrical resistance gauges, photoelasticity, etc. Prerequisite: Theoretical and Applied Mechanics 221 or equivalent. 3 hours, or 1/2 to 1 unit.
334. **Fluid Mechanics and Advanced Hydraulics.** A study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels, viscosimetry, dimensional analysis, effects of boundary conditions, cavitation, water tunnel, hydraulic jump, water hammer pumps, turbines. Some laboratory work. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or 3/4 or 1 unit.
335. **Dynamics of Fluids.** An intermediate course in the mechanics of fluids introducing analytical methods of solution for ideal and real fluids. Potential flow theory, theoretical approaches to viscous flows including boundary layer theory, and the analysis of compressible flows are indicated. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or 3/4 or 1 unit.
346. **Dimensional Analysis and Theory of Models.** Covers the nature and use of dimensions, systematic calculations and dimensionless products, algebraic theory of dimensional analysis, similarity and model laws, and derivation of model laws from differential equations. Applications include von Karman's theory of similarity in turbulent flow, boundary layer theory, topics in open channel flow, model laws for pumps and turbines, topics in structural analysis and vibration theory, topics in the theory of heat. 3 hours, or 1/2 or 1 unit.
351. **Fundamental Concepts of Deformable Body Mechanics.** Intended to provide an introduction to the general theories of kinematics of deformable bodies, general balance laws applicable to continuum mechanics, constitutive relations (stress-strain relations) as well as introductions to linear elasticity, linear viscoelasticity, and special concepts in other areas of solid mechanics and fluids. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343 and 345. 3 hours or 1 unit.

360. **Continuum Mechanics, I.** A unified treatment of modern continuum mechanics; linear algebra and analysis, review of kinematics and general balance laws, general theory of mechanical constitutive equations (simple materials). Prerequisite: Theoretical and Applied Mechanics 351 or equivalent. 3 hours or 1 unit.
373. **Engineering Acoustics.** Same as Electrical Engineering 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems. Vibrating string, vibrating membrane, plane waves, spherical waves, vibrating piston, acoustical filters, loudspeakers and microphones, principle of reciprocity, the ear, architectural acoustics. Students may not receive credit for both Theoretical and Applied Mechanics 373 and Electrical Engineering 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or 3/4 to 1 unit.
392. **Analysis and Synthesis of Problems.** Emphasizes the rational analysis of comprehensive problems and engineering systems. Prerequisite: Consent of instructor. 3 hours, or 1/2 to 1 unit.
400. **Seminar in Engineering Mechanics.** There are many special topics in the field of mechanics such as fracture of metals, creep of materials, etc., in mechanics of solids; fluid flow problems such as the nature of turbulence, boundary layer theory, nature and effects of roughness of boundary, effects of free surface; dynamics problems such as vibration of beams with moving loads, the gyroscope, etc. Certain other topics, such as biomechanics, cut across all areas of mechanics. Such special topics as these are covered in this course. Each semester one or more of these topics is selected and announced as the area to be covered in this course during that semester. 0 to 1/4 unit.
412. **Vibration Analysis.** Continuation of Theoretical and Applied Mechanics 311. Specific topics are systems of several degrees of freedom; applications of generalized coordinates and Lagrange's equations; boundary value problems in vibration of elastic bodies, including strings, rods, and beams; Stodola's methods; iteration process and matrix procedure; vibrations in reciprocating machines, airplane structures and propellers; impact and transient vibrations; self-excited vibration; stability; nonlinear systems. Prerequisite: Theoretical and Applied Mechanics 311 or equivalent. 1 unit.
416. **Energy Principles in Engineering Mechanics.** Designed to introduce the student to the variational principles of mechanics and their applications to engineering problems. The derivation, interpretation, and applications of the principle of virtual displacements, the principle of minimum potential energy, the principle of complementary energy. Castigliano's theorem, Hamilton's principle, and Lagrange's equations of motion constitute the main part of the course. Variational methods of approximation are treated briefly. The material includes numerous illustrative applications to stress analysis of statically determinate and statically indeterminate frames, problems of elastic stability, the theories of rings and curved beams, the theory of elastic plates, vibrations of structures, and wave motions. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
417. **Stochastic Structural Dynamics.** Same as Aeronautical and Astronautical Engineering 452. Linear structural dynamics problems treated from a probabilistic point of view; axiomatic probability theory and random processes; the response of linear structures to random excitation; practical problems in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 255 or Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
418. **Stochastic Processes in Engineering.** Same as Aeronautical and Astronautical Engineering 453 and Electrical Engineering 438. Supplementing Aeronautical and Astronautical Engineering 452, Electrical Engineering 434, or Theoretical and Applied Mechanics 417 for additional engineering application of stochastic processes. Theories of random pulses and continuous Markov processes and their applications to dynamic and control systems; parametric excitations and stability; nonlinear devices; topics related to system failures. Prerequisite: Aeronautical and Astronautical Engineering 452, Electrical Engineering 434, Theoretical and Applied Mechanics 417, or equivalent. 1 unit.

- 424. Properties of Engineering Materials.** Structure of metals and behavior of materials under various conditions of loading and use, including static, creep, fatigue, and impact; effects of high and low temperature, strain rate, state of stress, and internal structure; criteria of failure; relation of mechanical properties to behavior; significance of mechanical properties; tests and interpretation of test data; material specifications. 1/2 or 1 unit.
- 425. Mechanics of Inelastic Bodies.** The course presents methods of obtaining relations between loads, deformations, stresses, and strains in various members that are stressed beyond the elastic range. Most applications consider both time-independent and time-dependent (creep) inelastic deformations. Some specific topics are straight and curved beams, columns, and beam-columns, fully plastic analysis of statically indeterminate members and structures, torsion of circular and noncircular bars, and torsion-tension of bars of circular cross-section. Prerequisite: Theoretical and Applied Mechanics 321. 1/2 to 1 unit.
- 426. Stress and Deformation in Engineering Components.** Continuation of Theoretical and Applied Mechanics 321; energy principles, forces and moments in plane and three-dimensional indeterminate members; beams on elastic support; flat plates, thick-walled cylinders, rotating disks, including temperature stresses; contact stresses and deflections; values and significance of stress concentrations. Prerequisite: Theoretical and Applied Mechanics 321 or equivalent. 1/2 to 1 unit.
- 427. Theories of Mechanical Properties and Behavior of Plain Concrete.** Theories used in the design of concrete and the factors affecting the properties and behavior of the material and of the test piece. Behavior of plain concrete under different types of environment and of loading, such as long-time, repeated, and tri-axial, are emphasized. The studies involve critical reviews of experimental and analytical investigations. Prerequisite: Bachelor of Science in engineering. 1/2 to 1 unit.
- 428. Analysis of Nonlinear Systems.** Same as Electrical Engineering 428. Singular points and stability considerations are treated. Graphical and analytical methods including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations are considered. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
- 429. Theory of Linear and Nonlinear Viscoelasticity.** Same as Aeronautical and Astronautical Engineering 429. Fundamental concepts of viscoelasticity with applications. Elastic-viscoelastic analogies, creep and relaxation functions, thermo-mechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, torsion of nonlinear bars and shells. Prerequisite: Theoretical and Applied Mechanics 351 or Aeronautical and Astronautical Engineering 326, or consent of instructor. 1 unit.
- 431. Theory of Ideal Fluid Flow.** Together with Theoretical and Applied Mechanics 432, topics in advanced fluid mechanics are covered that are the basis of many modern developments. Ideal fluid theory is concerned with an incompressible fluid of negligible viscosity. The differential equations of motions are derived and the several methods of obtaining flow solutions are presented: the obtaining of velocity potentials and stream functions by superposition of the effects of source, doublets, and vortices, and by the methods of conformal mapping. Relations for finding the resultant forces and moments on bodies are derived and applied to bodies such as lifting surfaces. Other topics covered include the theory and application of free streamline flows, vortex motions, and surface wave theory. Prerequisite: An elementary course in fluid flow; a course in advanced calculus. 1 unit.
- 432. Theory of Flow of Viscous Fluids.** Although a logical continuation of Theoretical and Applied Mechanics 431, this course need not be taken sequentially. Concerned with the theoretical development, analysis, and solution of incompressible viscous fluid flow problems. Starting with the stress relations occurring in viscous fluids, the differential equations of motion are derived and direct and approximate solutions for laminar flows

- are developed. Boundary-layer theory is presented and the occurrence of turbulence and its characterization introduced. The basic equations for analyzing turbulent flows are introduced and approximate solution for flows in boundary-layers with and without pressure gradients (and separation) pipes and jets are presented. Includes consideration of experimental observation and application to technological problems. Prerequisite: An elementary course in fluid flow; a course in differential equations. 1 unit.
438. **Turbulence.** Starting with the statistical modes of characterizing turbulence, discussion covers statistical theory, energy considerations, and nature of turbulence in typical flows. Laboratory experiments are used to illustrate hot wire technique of turbulence measurements and the structure of turbulence. Prerequisite: Theoretical and Applied Mechanics 432 or equivalent. 1 unit.
441. **Applied Analysis in Engineering.** A course to provide training in applications of mathematics to engineering problems. Most of the illustrations are taken from engineering mechanics. Prerequisite: Mathematics 143; Mathematics 343 and 345 are recommended. 1 unit.
442. **Applied Analysis in Engineering.** Continuation of Theoretical and Applied Mechanics 441. Prerequisite: Mathematics 143; Mathematics 343 and 345 are recommended. 1 unit.
451. **Theory of Elasticity with Application to Engineering Problems.** A study of the mechanics of elastic deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain, and properties of materials. Relations between stresses, strains, and displacements are studied in detail with special consideration given to their significance in engineering problems. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343; Mathematics 341 or equivalent. 1 unit.
452. **Theory of Elasticity with Application to Engineering Problems.** Continuation of Theoretical and Applied Mechanics 451. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
454. **Theory of Shells.** A course designed to provide the theoretical basis of stress analysis of shell-type structure, such as ships, submarines, monocoque aircraft structures, concrete roofs and domes, pressure vessels, and containers for liquids. The material includes the differential geometry of shell theory, equilibrium equations, momentless theory of shells, strains in shells, statically indeterminate problems of shells, energy formulations, and stability of shells. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
457. **Classical Elastostatics.** A modern unified treatment of the concepts and techniques developed in the course of investigation of the Cauchy-Navier equations. Emphasis on the interpretation and motivation of ideas and their interrelation for the solution of three-dimensional problems. Topics include the classical boundary-value problems, existence and uniqueness theorems, stress functions and displacement potentials, singular states of stress, extension of Green's method to the equations of elasticity, method of series, and approximation techniques. Course represents a preparation for (1) students interested in the current state of knowledge in classical elasticity, and (2) students intending to do doctoral dissertations in classical elasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent; consent of instructor. 1 unit.
458. **Wave Motion in Continuous Media.** An analysis of the dynamics of deformable bodies with a major emphasis on elastic media. Introduces the terminology associated with and the methods of treating such problems. Includes a general discussion of the motion of strings, bars, shafts, plates, and other bodies when subjected to load. Detailed examination of approximations involved is made and their engineering significance is discussed. Prerequisite: Theoretical and Applied Mechanics 311, 314, 451; Mathematics 341, 342, 343, or equivalent. 1 unit.
460. **Continuum Mechanics, II.** Continuation of Theoretical and Applied Mechanics 360. Viscous fluids (without memory) and elastic bodies as examples of simple materials, general principles of continuum thermodynamics, thermodynamics of elastic bodies, selected topics in modern continuum mechanics. Prerequisite: Theoretical and Applied Mechanics 360. 1 unit.

- 462. Theory of Plasticity.** The physical and mathematical formulation of the mechanics of inelastically deformed bodies, plastic stress-strain laws, and their association with yield and loading function. Deals primarily with members subjected to bi-axial and tri-axial stress conditions. Specific topics include applications to flexure and torsion of prismatic members; expansion of thick-walled cylinders and spherical shells; introduction to problems in plane plastic flow and variational plasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent. 1/2 or 1 unit.
- 464. Theory of Buckling.** The pertinent information and theoretical background required for the prediction of failure by buckling of structures such as airplanes, ships, bridge trusses, fabricated towers and shells; practical illustrations. Specific topics are elastic columns with various end restraints; buckling of framework, arches, rings, and plates; inelastic buckling of columns and plates; lateral buckling of beams; energy theory; Ritz procedure; Euler's equation of the calculus of variations. Prerequisite: Theoretical and Applied Mechanics 416 and 451. 1/2 or 1 unit.
- 467. Thermomechanics of Nuclear Reactor Systems.** Same as Nuclear Engineering 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal-shock and thermal stress-wave propagation; current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
- 472. Advanced Photoelasticity.** Theoretical and practical aspects of modern photoelasticity. Topics include: three-dimensional photoelasticity, birefringent coatings, dynamic photoelasticity, photoplasticity, photoviscoelasticity, and photothermoelasticity. Prerequisite: Theoretical and Applied Mechanics 326, 451, or consent of instructor. 1 unit.
- 485. Fracture Mechanics.** Designed to acquaint students with the analytical and experimental techniques used to solve current fracture problems. Topics include (1) a discussion of the macroscopic theories used to determine the static strength of bodies containing cracks, (2) linear elastic fracture mechanics—the tool and the model, its relation to the Griffith criteria of fracture, (3) elastic-plastic fracture mechanics models—small scale-yielding results and their implication, (4) an introduction to fracture mechanics in the realm of general yielding. Examples of how the analytical methods can be applied are derived from discussion of the general fracture control plan. Prerequisite: Theoretical and Applied Mechanics 324 and 451, or consent of instructor. 1 unit.
- 493. Advanced Independent Study (Special Problems).** Analytical or experimental studies in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, theory of plasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, fatigue of metals, etc. 1/2 to 2 units.
- 499. Thesis Research.** 0 to 4 units.

Ukrainian

(See Slavic Languages and Literatures)

URBAN AND REGIONAL PLANNING

Head of Department: Professor M. P. BROOKS

Department Office: 909 West Nevada Street, Urbana

- 171. Planning of Cities and Regions.** A survey of city and regional planning as related to problems and programs of urbanization and resource development. 3 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 236. Urban Planning Studio, I.** Planning and design of the basic urban systems of physical facilities. Field work and problems in land use and circulation, community facilities, and urban design. Prerequisite: Architecture 171 or consent of instructor. 5 hours.

240. **Planning Internship.** Professionally supervised field experience in public and private planning or development agencies. Designed to introduce students to professional employment and actual planning practice. The student works in a University-approved agency of his own choice either during the summer session between his junior and senior years or part-time during a regular semester. Summary reports from both employer and student. Prerequisite: Senior standing or consent of instructor. 2 to 6 hours. No more than 8 hours of Urban Planning 240 and 340 may be applied toward the Bachelor of Urban Planning degree.
260. **Special Problems.** Special projects, research, and independent reading. Prerequisite: Consent of head of department. 2 to 6 hours.
337. **Urban Planning Studio, II.** The theory and development of the planning process as it applies to the study of an existing community including visual surveys, data collection and analysis, "momentum projections," plan making, and implementation programs. Prerequisite: Urban Planning 236 or consent of instructor. 6 hours, or 1 to 1 1/2 units.
338. **Urban Planning Studio, III.** Contemporary theories of urban design and structure; planning and design of new communities; circulation and public facilities systems; studies of alternative patterns of growth. Prerequisite: Urban Planning 337 or consent of instructor. 6 hours, or 1 to 1 1/2 units.
340. **Advocacy Planning Field Work.** The student is assigned as an observer and participant to work directly with disadvantaged persons or groups, usually through community advocacy agencies, human relations commissions, or comparable mechanisms. The student as advocate planner is responsible to the clients he serves, with faculty resource groups. Opportunities may be limited to insure continuity of service. Evaluation reports required. Prerequisite: Senior standing or consent of instructor. 2 to 6 hours, or 1/2 to 1 1/2 units. No more than 8 hours of Urban Planning 340 and 240 may be applied toward the Bachelor of Urban Planning degree; no more than 2 units of Urban Planning 340 and/or 440 may be applied toward the Master of Urban Planning degree, and these must be in addition to other minima required by the Graduate College and the Department of Urban and Regional Planning.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, General Engineering, Geography, Mechanical Engineering, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or 1/2 unit.
351. **History of Urban Planning.** Description and analysis of the development of urbanization and the planning of communities from ancient times to the present, as related to environmental and cultural influences. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or 1/2 unit.
374. **Urban Planning Theory.** An examination of the urban planning function within a theoretical, methodological, institutional, and professional context. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or 1/2 unit.
376. **Planning Analysis.** Research and analytic techniques in urban planning: economic base and employment; population; market analysis; derivation and use of statistical data. Prerequisite: Urban Planning 171 or consent of instructor. 4 hours or 3/4 unit.
377. **Comprehensive Planning Procedure.** Design and plan making techniques in urban planning; land use, circulation, and community facilities; the development of the comprehensive general plan. Prerequisite: Urban Planning 171. 4 hours or 3/4 unit.
378. **Planning Legislation and Administration.** Legal tools of planning, zoning, subdivision regulations, housing codes; methodology and application; administrative procedures; the place of planning in the structure of governments; the capital improvement program. Prerequisite: Political Science 150 and 151 or 305 and 306, or consent of instructor. 3 hours or 1/2 unit.
380. **Survey of Regional Planning.** Concepts and procedures for planning of regions; river valley, metropolitan, state, and national planning. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or 1/2 unit.

- 382. The Language and Thought of Urban Planning.** The nature of urban planning thought; the meaning of its basic terms and concepts; the philosophic issues and choices of meaning facing the future professional. Trends of thought in urban planning literature. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.
- 384. Urban Design and Planning Methods.** Concepts and techniques of urban analysis, plan-making, and implementation essential for effective interdisciplinary work in urban design. Case studies of major types of large-scale projects. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or 3/4 unit.
- 437. Advanced Urban Planning Studio.** Analysis and synthesis problems related to design and development programming for cities, metropolitan areas, and urban regions. 1 to 2 units. Prerequisite: Urban and Regional Planning 337, 338, and 374, or consent of instructor.
- 440. Professional Internship.** Summer, part-time, or other professional-level employment in the field of planning, usually in an area of concentration. The student is exposed to the social, political, and institutional setting in which planning operates. Full documentation of internship activities required. Prerequisite: Consent of instructor. 1 to 2 units. Not more than 2 units of Urban Planning 440 and/or Urban Planning 340 may be applied toward the Master of Urban Planning degree, and these must be in addition to the other minima required by the Graduate College and the Department of Urban and Regional Planning.
- 463. Housing and Urban Policy Planning.** The role of housing in social policy planning; methodologies for analyzing the housing market with regard to social planning issues; demand and supply trends in American housing related to historic and projected social, economic, and physical changes. Prerequisite: Undergraduate course in micro-macro economics or consent of instructor. 1/2 to 1 unit.
- 477. Economics for Urban Planners.** An introduction to micro-economic and macro-economic theory, in a context related to the needs of professional planners. Special references to problems of land use, transportation, public facilities, and urban social problems. Techniques include theory of the firm, consumer theory, input-output analysis, and welfare economics. Prerequisite: Calculus; first course in economics desirable but not necessary. 1 unit.
- 487. Seminar.** Prerequisite: Urban and Regional Planning 374. 1/2 unit.
- 488. Urban Planning Research.** Individual and group instruction in the application of professional competences in urban planning to the analysis of urban development problems and to the formulation of approaches to solution of such problems. Prerequisite: Consent of head of department. 1/2 to 2 units.
- 492. Seminar on Models for Directed Change.** Same as Sociology and Social Work 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels. Construction of models as interpretations of behavioral science theory; extrapolating of hypotheses and of guides to intervention from the models. Readings from several disciplines as relevant. Prerequisite: Consent of instructor. 1/2 to 1 unit.
- 499. Thesis Research.** Prerequisite: Graduate standing in urban and regional planning. 1/2 to 2 units.

VETERINARY BIOLOGICAL STRUCTURE

Head of Department: Professor J. E. LOVELL

Department Office: 335 Veterinary Medicine Building

- 300. Gross Anatomy.** Same as Veterinary Medical Science 300. Systematic and topographic study and dissection of the dog. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 5 hours.

301. **Histology.** Same as Veterinary Medical Science 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, with special reference to domestic animals. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 4 hours.
302. **Gross Anatomy.** Same as Veterinary Medical Science 302. Comparative study and dissection of the domestic animals with special reference to development and adaptation to function. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 4 hours.
303. **Microscopic Organology.** Same as Veterinary Medical Science 303. Microscopic study of the organ systems of different domestic animals. Lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
304. **Applied Anatomy, I.** Structural consideration of domestic and pet animals relative to diagnostic and surgical procedures. Required in veterinary curriculum. Prerequisite: Registration in third year of veterinary curriculum or consent of instructor. 1 hour.
305. **Developmental Anatomy.** Same as Veterinary Medical Science 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals. Lectures and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
306. **Applied Anatomy, II.** Continuation of Veterinary Biological Structure 304. Structural considerations of domestic and pet animals relative to diagnostic and surgical procedures. Required in veterinary curriculum. Prerequisite: Veterinary Biological Structure 304 and registration in third year of veterinary curriculum, or consent of instructor. 1 hour.

VETERINARY CLINICAL MEDICINE

Head of Department: Professor A. J. CAWLEY

Department Office: 244 Small Animal Clinic

360. **Diseases of Small Animals, I.** Diagnosis, treatment, and prophylaxis of infectious, noninfectious, and surgical diseases of the small domestic animals. Lectures, quizzes, and demonstrations. Required in the veterinary curriculum. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
361. **General Veterinary Surgery.** Surgical principles including hemostasis, shock, fluid, and electrolyte balance. Discussion of the surgical procedures of the major systems of the body and the aftercare of the patients, both farm and domestic pet species. Laboratory covers practice and demonstrations of the principles of surgery involved in the major body systems. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
362. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Lectures, quizzes, and demonstrations. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
363. **Reproduction, Obstetrics, and Genital Diseases.** Principles of animal reproduction, fertility, and obstetrics of all species of domestic animals with emphasis on farm animals. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
364. **Diseases of Large Animals, I.** Diagnosis, treatment, and prevention of noninfectious, nutritional, metabolic, toxic, and parasitic diseases of large animals. Lecture and discussion. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
365. **Special Veterinary Surgery.** Lectures and clinical demonstrations on surgical diseases and their diagnosis, operative treatment, and aftercare, together with appropriate laboratory practice. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 5 hours.

366. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
367. **Radiology.** General principles of radiology including techniques and application to the diagnosis and therapy of animal diseases. Lectures and discussions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours.
368. **Medicine, Large Animal.** Diagnosis, treatment, and prophylaxis of infectious diseases of large animals. Lectures, discussions, and quizzes. Prerequisite: Fourth-year standing in veterinary curriculum. 5 hours.
369. **Diseases of Small Animals, II.** Diagnosis, treatment, and prophylaxis of contagious diseases of the dog and cat; diagnosis and treatment of diseases of the eye and ear. Lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 2 hours.
370. **Seminar.** Assigned reading and discussion of cases presented for diagnosis and treatment. Prerequisite: Fourth-year standing in veterinary curriculum. 0 credit.
371. **Clinical and Laboratory Practice.** Clinical and laboratory practice on diagnosis, treatment, and prophylaxis of animal diseases. Fourth-year veterinary students enrolled in this course spend two days at the Dixon Springs Agricultural Center at Simpson, Illinois, where they participate in the fall roundup and gain valuable experience in the handling, examination, and treatment of diseases of range cattle. Approximate cost of this trip is \$10.00. Transportation to and from Dixon Springs Agricultural Center is furnished. Prerequisite: Fourth-year standing in veterinary medicine. 8 hours.
372. **Veterinary Jurisprudence.** Principles of law of importance to members of the veterinary profession; animal diseases and related regulatory laws and their administration; federal procedure under animal disease and food and meat inspection laws. Prerequisite: Fourth-year standing in veterinary curriculum. 2 hours.
373. **Principles of Veterinary Medical Ethics.** Principles of veterinary medical ethics adopted by the American Veterinary Medical Association and discussed together with the importance of professional ethics to members of the veterinary medical profession. Prerequisite: Fourth-year standing in veterinary curriculum. 0 credit.
374. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Fourth-year standing in veterinary curriculum. 10 hours.
375. **Reproduction, Obstetrics, and Genital Diseases.** Lectures, discussion, and laboratory practice in obstetrics, pregnancy diagnosis, and male and female infertility. Prerequisite: Veterinary Clinical Medicine 363; third-year standing in veterinary curriculum. 2 hours.
376. **Economics and Business Management for the Veterinarian.** Summary of management in a practice of veterinary medicine. Emphasis on the application of economic principles of record analysis, personnel management, business organization, and financial management. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.

VETERINARY MEDICAL SCIENCE

Assistant Head of Department: Professor K. W. SLOAN
Department Office: 141 Veterinary Medicine Building

300. **Gross Anatomy.** Same as Veterinary Biological Structure 300. Systematic and topographic study and dissection of the dog. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Five hours of zoology; consent of instructor. 1 unit.
301. **Histology.** Same as Veterinary Biological Structure 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, skin and organs of special sense with special reference to domestic animals. Prerequisite: Consent of instructor. 1 unit.

302. **Gross Anatomy.** Same as Veterinary Biological Structure 302. Comparative study and dissection of the domestic animals with special reference to development and adaptation to function. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. 1 unit.
303. **Microscopic Organology.** Same as Veterinary Biological Structure 303. Microscopic study of the organs and systems of different domestic animals. Lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. 3/4 unit.
305. **Developmental Anatomy.** Same as Veterinary Biological Structure 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals. Lectures and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. 3/4 unit.
307. **Correlative Mammalian Neuroanatomy.** Organization of nuclei and tracts of the central nervous system; morphologic specializations related to behavioral peculiarities of domestic and laboratory mammals; gross and microscopic examination of material from primates, rodents, carnivores, and ungulates. Prerequisite: Veterinary Medical Science 300, Zoology 232, or consent of instructor. 1 unit.
315. **Veterinary Physiology.** Same as Veterinary Physiology and Pharmacology 315. Nervous systems, respiration, acid-base balance, urine formation, body fluids and their regulation, muscular systems. Lectures, discussions, and laboratory. Prerequisite: Consent of instructor. 1 1/4 units.
316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Physiology and Pharmacology 316. Blood and lymph, circulation, digestion, metabolism, and endocrine systems. Lectures, discussions, and laboratory. Prerequisite: Veterinary Medical Science 315 or consent of instructor. 1 unit.
318. **Pharmacology.** Same as Veterinary Physiology and Pharmacology 318. General principles of pharmacy and an analysis of the action of chemical agents on physiological processes. Lectures, discussions, demonstrations, and laboratory. Prerequisite: Credit or registration in Veterinary Medical Science 315 and 316; consent of instructor. 1 unit.
320. **Pharmacology and Toxicology.** Same as Veterinary Physiology and Pharmacology 320. Principles of drug action and an analysis of action of chemical agents on living organisms including intoxications of domestic animals. Lectures, discussions, and demonstrations. Prerequisite: Veterinary Medical Science 318 or consent of instructor. 1 unit.
332. **Veterinary Microbiology and Immunology.** Same as Veterinary Pathology and Hygiene 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance and the properties, pathogenesis, and control of viral infection of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or equivalent; consent of instructor. 1 unit.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Pathology and Hygiene 333. Protozoan and arthropod parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Courses in chemistry or animal biology, or both, totaling twenty semester hours; consent of instructor. 3/4 unit.
334. **General Pathology.** Same as Veterinary Pathology and Hygiene 334. The basic principles of pathological process, including tissue injury and repair, circulatory and metabolic disturbances, inflammation and neoplasia. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Courses in histology, parasitology, physiology, and microbiology totaling twenty-five semester hours; consent of instructor. 1 unit.
335. **Special Pathology.** Same as Veterinary Pathology and Hygiene 335. Disease processes affecting organs and anatomic systems and those occurring in specific diseases. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 334 or equivalent; consent of instructor. 1 unit.
336. **Helminth Parasites.** Same as Veterinary Pathology and Hygiene 336. Helminth parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Courses in chemistry or animal biology or both totaling twenty semester hours; consent of instructor. 3/4 unit.

- 340. Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 111 or 112 or 104, or equivalent. 3/4 unit.
- 346. Management and Diseases of Laboratory Animals.** Same as Veterinary Pathology and Hygiene 346. Principles of management of conventional and gnotobiotic laboratories emphasizing proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 1/2 unit.
- 348. Air Pollution Seminar.** Same as Civil Engineering, Agricultural Engineering, General Engineering, Geography, Mechanical Engineering, and Urban and Regional Planning 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. 1/2 unit.
- 369. Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 1/2 or 1 unit.
- 374. Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Veterinary Medical Science 369. 1 unit.
- 392. Special Problems.** Individual research on a special problem chosen in consultation with the instructor and department head. May be repeated for a total of one unit. Prerequisite: Registration in veterinary curriculum with grade-point average of 4.0 or above, or consent of instructor. 1/2 unit.
- 408. Principles of Hematology.** The cellular morphology of the blood and bone marrow of animals in health and disease. Lectures, discussions, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 301 or equivalent, or consent of instructor. 1/2 unit.
- 413. Experimental Mammalian Physiology, I.** Same as Physiology 413. The physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
- 414. Experimental Mammalian Physiology, II.** Same as Physiology 414. The physiological applications of experimental pharmacodynamics. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
- 415. Mechanisms of Microbial Infections.** Newer concepts of host-microorganism relations with emphasis on the dynamics and pathogenic mechanisms of microorganisms, immune responses and defense factors of the host, and pathogenesis of specific infections. Lectures, discussions, laboratory, and special problems. Prerequisite: Microbiology 326 or Veterinary Medical Science 332, or equivalent; consent of instructor. 3/4 unit.
- 416. Epizootiology.** Principles and problems of epizootiology with special consideration of the zoonoses; ecology of the host and parasite as related to resistance, adaptation, perpetuation, and distribution; the principles and factors in interference, carrier and latent states, reservoirs and control. Prerequisite: Veterinary Pathology and Hygiene 331, Veterinary Medical Science 332, or equivalent, or consent of instructor. 1 unit.

417. **Medical Mycology.** Study of the fungi that cause infections in man and animals; taxonomy, methodology, epidemiology, pathology, and diagnosis. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent. 1 unit.
418. **Concepts and Topics in Immunology.** Same as Biology 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunologic tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor; Microbiology 327 and Biology 307 are recommended. 1/2 unit.
419. **Animal Virology.** Same as Microbiology 419. A discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology, supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327 or Veterinary Pathology and Hygiene 331 and Veterinary Medical Science 332; Chemistry 350 or 354; consent of instructor. 3/4 unit.
425. **Experimental Parasitology.** Same as Zoology 425. A broadly based consideration of the relation of parasites to their hosts and to their environments, and of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Chemistry 350; biochemistry and statistics are recommended. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 440. Statistical methods as tools for research. Principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Veterinary Medical Science 340 or equivalent. 3/4 unit.
445. **Advanced Macroscopic Pathology.** Concepts and interpretations of gross pathologic changes and the integration of host-parasite reactions. Prerequisite: Veterinary Medical Science 334 and 335, or equivalent; consent of instructor. 1/2 or 1 unit.
450. **Advanced Veterinary Pathology.** Advanced study of gross and microscopic pathology of diseases of domestic animals. Prerequisite: Veterinary Medical Science 335 or equivalent. 1 unit.
455. **Comparative Oncology.** A comparative study of the nature of mammalian and avian neoplasms based on general and special methods of tumor identification, classification, and experimentation. Lectures, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 445 and 459, or equivalent. Required course for students majoring in pathology in Department of Veterinary Medical Science. 1 unit.
457. **Ultrastructural Pathology.** Ultrastructural basis of pathologic processes occurring in animal tissues and cells. Lectures, discussions, and reports. Prerequisite: Zoology 430; consent of instructor. 3/4 or 1 unit.
459. **Advanced Correlative Pathology.** Discussion and interpretation of disease processes of domestic animals. Emphasis on the correlation of gross, microscopic, and clinicopathologic findings with alterations of function. Prerequisite: Veterinary Medical Science 308, 335, 445, 450, or equivalent; consent of instructor. 0 to 1 1/2 units.
460. **Advanced Veterinary Physiology.** Advanced study of physiology, nutrition, and biochemistry as related to problems in veterinary medical science. Problems studied include white muscle disease, sweet clover disease, ketosis, hypoglycemia and digestive disturbances. Laboratory includes planning, executing, and reporting a specific course project. Prerequisite: Veterinary Medical Science 315, 316, or equivalent; consent of instructor. 1 unit.
461. **Advanced Veterinary Pharmacology.** Evaluation of drugs, pharmacological aspects of biological antagonisms, chemotherapy, antibiotics, chelating agents and chemical biological correlation. Prerequisite: Consent of instructor. 3/4 unit.
463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Animal Science and Biophysics 463. Lectures, demonstrations, and laboratory on the fundamentals of

radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, biology, and/or consent of instructor. 3/4 unit.

464. **Mineral Metabolism.** Physiology, nutrition, and biochemistry of minerals. Mineral regulatory mechanisms; mineral membrane transport; mineral abnormalities. Lectures, discussions, and reports. Prerequisite: Veterinary Medical Science 316 or Physiology 301 and 302, or equivalent, or consent of instructor. 3/4 unit.
465. **Comparative Pharmacodynamics.** The comparative study of drug effects and the handling of drugs by various organisms. Emphasis is placed on mode of action of elements and chemical compounds. Factors influencing absorption, distribution, metabolism, and excretion of drugs are included. Prerequisite: Three courses in biology; four courses in chemistry including biochemistry; consent of instructor. 3/4 unit.
466. **Comparative Environmental Toxicology and Drug Resistance.** The chemistry, mechanisms, actions, and disposition of substances toxic to man and other animals. Nature of host-toxicant interactions and the biological consequences of such interactions including toxicological mechanisms and their public health significance. Prerequisite: Veterinary Medical Science 465 or consent of instructor. 3/4 unit.
490. **Seminar.** Required of all graduate students whose major is veterinary medical science. 1/4 unit.
491. **The Experimental Method in Veterinary Research.** Planning of experiments, use of controls, interpretation of results, sources of error, and writing the research report. 1/2 unit.
492. **Special Problems.** Basic and applied study including orientation and research on pertinent initial and continuing problems in the student's area of interest. Prerequisite: Consent of instructor. 1/4 to 1 unit.
499. **Thesis Research.** 0 to 4 units.

VETERINARY MEDICINE

Program Administrator: Professor L. M. JONES

Office: 131 Veterinary Medicine Building

392. **Special Problems.** Individual research on a special problem chosen after consultation with the instructor and department head. Prerequisite: Professional standing in veterinary curriculum; 3.5 grade-point average. 3 hours. May be repeated to a total of 6 hours.

VETERINARY PATHOLOGY AND HYGIENE

Head of Department: Professor L. E. HANSON

Department Office: 57 Veterinary Medicine Building

330. **Veterinary Medical History and Orientation.** An introduction to the history, recent developments, scope, and trends of veterinary medical education, practice, research, public health, and other areas. Functions, obligations and organization of the profession. Prerequisite: First-year standing in veterinary curriculum. 0 credit.
331. **Veterinary Bacteriology.** A study of the properties of bacteria responsible for diseases of domestic and wild animals with special emphasis on transmission, propagation, pathogenesis, and diagnosis. Prerequisite: First-year standing in veterinary curriculum or consent of instructor. 5 hours.

332. **Veterinary Microbiology and Immunology.** Same as Veterinary Medical Science 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance, and the properties, pathogenesis, and control of viral and fungal infections of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or consent of instructor. 4 hours.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Medical Science 333. Protozoan and arthropod parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
334. **General Pathology.** Same as Veterinary Medical Science 334. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, inflammation and neoplasms. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
335. **Special Pathology.** Same as Veterinary Medical Science 335. Disease processes affecting organs and anatomic systems and those occurring in specific diseases. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 5 hours.
336. **Helminth Parasites.** Same as Veterinary Medical Science 336. Helminth parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
337. **Clinical Pathology Conference.** Well-documented cases are presented to the student body with staff and student body participation in the discussion with the express purpose of more thoroughly integrating the basic sciences with clinical veterinary medicine. Prerequisite: Third-year standing in professional curriculum. No credit.
338. **Clinical Pathology.** Discussion of the function and interpretation of hematological, parasitological, chemical, and certain other procedures as aids in the diagnosis of animal diseases. Emphasis is placed on the correlation of laboratory findings with fundamental changes and clinical manifestations of disease. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
339. **Clinical Pathology Conference.** Well-documented cases are presented to the student body with staff and student body participation in the discussion with the express purpose of more thoroughly integrating the basic sciences with clinical veterinary medicine. Prerequisite: Veterinary Pathology and Hygiene 337. No credit.
340. **Diseases of Poultry.** The causes, symptoms, lesions, prevention, and treatment of noninfectious and infectious diseases of domestic birds. Lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 3 hours.
341. **Food Hygiene and Public Health.** General principles of public health; antemortem and postmortem inspection of food animals; the procedures and techniques used in the inspection of food of animal origin for type, class, and grade; diseases of animals transmissible to man. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 5 hours.
346. **Management and Diseases of Laboratory Animals.** Same as Veterinary Medical Science 346. Principles of management of conventional and gnotobiotic laboratories emphasizing proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 2 hours.

VETERINARY PHYSIOLOGY AND PHARMACOLOGY

Head of Department: Professor R. P. LINK

Department Office: 263 Veterinary Medicine Building

202. **Physiology of Domestic Animals.** Lectures, quizzes, and demonstrations. Prerequisite: Chemistry 101 or 102, or equivalent. 3 hours.
315. **Veterinary Physiology.** Same as Veterinary Medical Science 315. Nervous system respiration, acid-base balance, urine formation, body fluids and their regulation, muscular systems. Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Medical Science 316. Blood and lymph circulation, digestion, metabolism, and endocrine systems. Lectures, discussions, and laboratory. Required in veterinary curriculum. Prerequisite: Veterinary Physiology and Pharmacology 315 or consent of instructor. 4 hours.
318. **Pharmacology.** Same as Veterinary Medical Science 318. General principles of pharmacy and an analysis of the action of chemical agents on physiological process. Lectures, discussions, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 4 hours.
319. **Veterinary Radiophysiology.** Lectures and laboratories dealing with basic principles and applications of radiation and radioisotopes to veterinary clinical medicine and research. Prerequisite: For veterinary students, second-year standing in veterinary curriculum or consent of instructor; for non-veterinary students, Chemistry 122 and 133 or 234, or equivalent. 2 hours.
320. **Pharmacology and Toxicology.** Same as Veterinary Medical Science 320. Principles of drug action and an analysis of the action of chemical agents on living organisms, including intoxications of domestic animals. Lectures and laboratory. Prerequisite: Veterinary Physiology and Pharmacology 318 or consent of instructor. 4 hours.
324. **Veterinary Nutrition.** Physiologic and pathologic aspects of nutritional deficiencies in domestic animals. Therapeutic principles are presented. Lectures and field trips. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 3 hours.

VOCATIONAL AND TECHNICAL EDUCATION

Chairman of Department: Professor L. J. PHIPPS

Department Office: 345 Education Building

101. **Nature of the Teaching Profession.** An introduction to educational problems; a general study of the nature of teaching, its opportunities and responsibilities. Through individual work the student is helped to evaluate his potentialities for teaching. 2 hours.
181. **Introductory Woodwork.** Beginning course in hand woodwork, with emphasis on both manipulative skills and related technical material. One section of this course is offered for majors in industrial education and another for students in the occupational therapy curriculum. 4 hours.
182. **Advanced Course in Woodwork.** Advanced course in design and construction of woodwork projects with related technical information. Prerequisite: Vocational and Technical Education 181. 4 hours.
183. **General Metalwork.** A basic course in general metalwork. Materials, tools, problems, and processes in bench metalwork, foundry, introductory gas and arc welding. 4 hours.
188. **General Shop for Elementary and Special Education Teachers.** Includes manipulative processes and the study of tools and materials appropriate for craft and shop activities in the elementary school and in special education classes. 3 hours.

189. **Supervised Occupational Experience.** Designed to provide students preparing to teach in the vocational and technical fields the occupational experience necessary or appropriate to complete the requirements in these curricula. Students who are employed and concurrently enrolled in this course complete assignments covering the related technical information of their chosen fields and undergo regularly scheduled written, oral, and performance examinations. Application for a job assignment must be made three months prior to the semester in which placement is desired. Prerequisite: Sophomore standing. 2 or 3 hours. Repeated enrollments permitted to a maximum of 17 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
240. **Principles of Vocational and Technical Education.** Designed to provide each specialized educational worker with a common orientation as to the major responsibilities of the public school as a unit and his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Vocational and Technical Education 101; Psychology 100. 2 hours.
249. **Independent Study.** Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upper-classman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
270. **Technic and Curriculum Development for Teaching Secretarial and Office Practice Subjects.** Review of results of current research and experimentation in the teaching of typewriting, shorthand, and other office practice subjects; review of basic education principles relative to skill development, and introduction of the student to the use of new innovations and technology, and their implications for office education. Proficiency level in typewriting and shorthand must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.
271. **Technic and Curriculum Development for Teaching Data Processing and Office Machines.** Introduction of techniques for teaching the operation of a variety of office machines used for processing data; introduction of current methods of teaching the use of automated data processing equipment and requirements for employment. Proficiency level in the operation and theory of operation of office machines used for processing data must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.
275. **Summer Experience in Agricultural Education.** Supervised experience in the work of a teacher of vocational agriculture during a two- or three-week period in the summer; planning summer work, teaching adult classes, supervising the farm practice of high school and adult students, advising school-sponsored organizations, counseling students, studying a community, becoming acquainted with facilities for agricultural education, and becoming familiar with situations in which the student will later do six weeks of student teaching during a school year. Course work is completed during the summer with official registration in the fall semester. Prerequisite: History and Philosophy of Education 201. 2 or 3 hours.
276. **Student Teaching in Vocational Agriculture.** Supervised experience in the work of a teacher of vocational agriculture during a six-week period; planning programs of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; keeping records and making reports. Prerequisite: History and Philosophy of Education 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 277. 5 hours.
277. **Programs and Procedures in Agricultural Education.** Preparation for a successful experience in practice teaching and for beginning work as a teacher of vocational agriculture; procedures in planning a community program of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; keeping records and making reports. Prerequisite: History and Philosophy

- of Education 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 276. 5 hours.
- 278. Vocational Education in Home Economics for Adults.** Study of adult education and the planning, promotion, and evaluation of adult education in home economics. Includes observation and participation in homemaking classes for adults in the local community. Prerequisite: Senior standing; registration in Secondary and Continuing Education 241 and Educational Practice 242. 3 hours.
- 280. General Drafting for Teachers.** An integrating course organized for the purpose of preparing industrial education students to teach drafting. Deals primarily with the problems of organizing and teaching drafting courses. Prerequisite: General Engineering 101; Architecture 141. 3 hours.
- 284. Advanced Metalwork.** Intermediate and advanced operations with hand and machine tools; the designing, planning, and constructing of machine shop projects; a study of ferrous and nonferrous materials appropriate for machine shop work. Prerequisite: Vocational and Technical Education 183. 4 hours.
- 285. General Electricity.** A basic course in introductory general electricity, theory, and shop practice. Principles of electricity applied to elementary shop problems in areas of house wiring, communications, construction and repair of household appliances, and fractional horsepower motors and generators. Prerequisite: Vocational and Technical Education 183. 3 hours.
- 287. General Electronics.** A basic course in introductory general electronics, theory, and shop practice. Vacuum tube circuit principles applied to shop problems in the areas of radio and television communications, audio reproduction and transmission systems, and industrial control systems for industrial arts teachers. Prerequisite: Vocational and Technical Education 285. 3 hours.
- 291. Thesis.** Prerequisite: Senior standing. 2 hours.
- 292. Thesis.** Prerequisite: Senior standing. 2 hours.
- 349. Special Study and Investigation in Vocational and Technical Education.** A course to offer opportunity for an individual to study, on or off campus, selected problems, trends, and new developments, or to conduct specialized technological investigations for the improvement of instructional programs in areas related to vocational and technical education. Prerequisite: Consent of instructor; demonstrated ability to pursue special study or investigation proposed. 2 to 4 hours, or 1/2 to 1 unit.
- 370. Agricultural Education for First-Year Teachers.** Specific help with the problems of beginning teachers. Campus meeting in August. Other meetings in centers in the state convenient to first-year teachers. Visits by instructors to schools in which first-year teachers are employed. Prerequisite: Vocational and Technical Education 276 and 277. 3 hours or 1/2 unit.
- 381. Principles of Vocational Education.** Study of basic concepts and practices of modern vocational education. 3 hours, or 1/2 or 1 unit.
- 382. Cooperative Vocational and Technical Education Programs.** The course is designed to provide the specific professional background required of teachers, coordinators, and administrators who organize and conduct public school programs utilizing community resources and experiences. The course includes the background, philosophy, organization, and administration of cooperative education. 2 or 4 hours, or 1/2 or 1 unit.
- 383. Development, Organization, and Principles of Industrial Education.** A survey of the problems and practices of the several phases of industrial education. 3 hours, or 1/2 or 1 unit.
- 384. The General Shop Program.** A laboratory and theory course in the organization and administration of the industrial arts general shop program. Prerequisite: Sixteen hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.
- 385. Problems in Concurrent Work-Education.** While employed in approved cooperating business firms, students observe the relationships between their activities and the specialized educational programs in the high school and community college. In class sessions,

- emphasis is placed on job analysis, current trends, wage and benefit structure, personnel practices, labor relations, and their implications for teaching. Prerequisite: Completion of prescribed courses in vocational and technical education for teaching in their area of specialization; consent of instructor. 4 hours or 1 unit.
387. **Training Programs in Industry.** A study of the organization, instruction, supervision, and evaluation of training programs conducted within industry, and their relationships to other educational agencies. 4 hours or 1 unit.
388. **Special Techniques of Teaching Vocational-Industrial Subjects.** A study of the application of principles of industrial education in vocational-industrial education. Methods of developing industrial skills, appropriate vocational attitudes, and related technical knowledge are stressed. Lectures, discussions, and demonstrations. Prerequisite: Junior standing; ten hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.
399. **Issues and Developments in Vocational and Technical Education.** A special course for experimentation or for seminar on topics not treated by regularly scheduled courses. Requests for initiation of this course may be made by students or faculty members. 2 or 4 hours, or 1/2 or 1 unit. May be repeated for a maximum of 8 hours or 2 units.
442. **Junior College.** Same as Higher Education 442. The place of the junior college in the modern program of public education; social, economic, and other changes responsible for development of post-secondary education as found in junior colleges, area vocational schools, and technical institutes. 1 unit.
445. **Investment in Human Resources.** Same as Labor and Industrial Relations 445. Activities which influence future monetary and psychic income by improving the resources in people. The investments covered include schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes, with main emphasis on education. A last section covers educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.
448. **Continuing Education.** Same as Secondary and Continuing Education 448. Development, status, and prospects of continuing education for adults. Institutions, agencies, and programs; public policy and policy-making for continuing education; organization, administration, finance, and promotion; recruiting, training, and supervising staff; planning programs and courses; the literature of continuing education. Systematic study of individual problems supplements class work. 1/2 or 1 unit.
449. **Independent Study.** To offer opportunity and challenge of self-directive, independent study i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. 1/2 or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
450. **Evaluation in Home Economics Education.** Theory and techniques of evaluation in home economics at different educational levels; analysis and refinement of instruments, interpretation of results for self-evaluation and guidance, and effective administration of programs. 1 unit.
451. **Directing Personnel Development in Vocational, Technical, and Practical Arts Education.** Principles and techniques for development of personnel in programs of vocational, technical, and practical arts education. The course emphasizes personnel development and instructional supervision of paraprofessionals, employers, and foremen of vocational and technical education students. Prerequisite: One unit in vocational and technical education, or consent of instructor. 1 unit.
453. **Problems in Home Economics Education.** Designed to prepare "consumers of research" through a comprehensive study and evaluation of home economics investigations now available and through the experience of carrying out an individual investigation of limited scope. 1 unit.

- 456. Problems and Trends in Specialized Fields of Vocational and Technical Education.** This course introduces the student to significant problems, points of view, and trends in the field concerned. Significant research relating to organization, content, and techniques in the field in question is explored. Students are encouraged to make special studies in approved areas. Sections are usually offered in the following fields: (a) agricultural education, (b) business education, (c) home economics education, (d) industrial education. 1 unit.
- 459. Workshop in Curriculum Development.** Curriculum development projects in the specialized fields of agriculture, business, home economics, and industry. 1/2 to 2 units.
- 471. Policy and Program Development in Vocational, Technical, and Practical Arts Education.** Local, state, and national policies for vocational and technical education; organizing for policy-making and program development; developing desirable policies and programs. 1 unit.
- 472. Course Planning and Teaching Procedures in Agricultural Occupation Programs.** Gathering data essential in course planning, constructing course plans, developing resource units, teaching procedures, and instructional aids. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. 1/2 unit.
- 473. Vocational Education in Agriculture for Adults.** The case for adult education, needs of young and adult farmers for education, development and present status of adult education in agriculture, objectives, evaluation, using advisory committees, organizing adult classes, enrolling students, course planning, teaching procedures and aids, supervised practice, group activities, facilities. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. 1/2 unit.
- 474. Supervised Agriculture Experience in Agricultural Occupation Programs.** Supervised agricultural experience programs as an educational strategy; importance and meaning of supervised agriculture experiences; planning, conducting, supervising, and evaluating agriculture experience programs; relation of supervised agriculture experience programs to establishment and advancement in an occupation; keeping and using records; relating class instruction to supervised agriculture experience programs. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. 1/2 unit.
- 475. Organizing and Teaching Agriculture Mechanics.** Agriculture mechanics as a phase of vocational education in agriculture: purposes, course planning for high-school students, young farmers, and adults; methods of teaching and evaluating on-farm or on-job instruction; planning agriculture-mechanics shops and facilities; providing and teaching safety in agriculture mechanics. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. 1/2 unit.
- 476. Guidance in Vocational, Technical, and Practical Arts Education.** The guidance function of a vocational or technical teacher, identifying and selecting students for vocational and technical programs, determining manpower and job requirements, providing occupational information, placing graduates, counseling parents, students, foremen, advisory committee members, union members, and employers, and conducting follow-up studies. 1 unit.
- 481. History and Basic Concepts of Vocational Education.** A course in the historical development of modern vocational education, the educational theories underlying its development, and the educational concepts upon which present programs and procedures are based. 1 unit.
- 482. Research Studies in Vocational and Technical Education.** Study and evaluation of examples of research in this field; a consideration of the research needed to solve present problems. Each student proposes and completes a brief research project, or plans in detail a major research project to be completed later. 1 unit.
- 487. Seminar in Vocational, Technical, and Practical Arts Education.** Overview and interpretation of social, economic, and technological trends which have relevance to the problem of developing new programs in the vocational, technical, and practical arts areas; analysis and evaluation of innovations in the field; current issues and problems. Prerequisite: Graduate standing in vocational and technical education. 1 unit.
- 488. Curriculum Problems and Trends in Industrial Education.** Selection and organization

of instructional materials for industrial courses; study of basic concepts underlying course construction in industrial education. Prerequisite: Undergraduate work in appropriate vocational and technical education courses. 1 unit.

489. **Administration of Vocational and Technical Education.** Problems and approved practices in the administration and supervision of programs of vocational, technical, and practical arts education in secondary schools, junior colleges, and technical institutes. Prerequisite: Consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in vocational and technical education open only to persons who have been admitted for doctoral study in vocational and technical education. Sections of this seminar are usually offered in the following areas: (a) industrial education, (b) agricultural education, (c) home economics education, (d) business education, and (e) general vocational and technical education. 1 to 2 units.
491. **Field Study and Thesis Seminar.** The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

Yoruba

(See Linguistics)

Zoology

(See Life Sciences)

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Additional Information

For information about admission, scholarships and fellowships, requirements of a particular curriculum, school, or college, or general questions about the University and its offerings and requirements, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS, University of Illinois, Urbana 61801

The Director of Admissions and Records will also send you on request copies of the Undergraduate Study catalog and semester Time Tables.

Publications of the following colleges and departments of the University may be obtained by writing directly to the unit concerned:

College of Agriculture	Institute of Labor and Industrial Relations
Institute of Aviation	College of Law
College of Commerce and Business Administration	Graduate School of Library Science
College of Communications	Occupational Therapy
College of Engineering	College of Physical Education
College of Fine and Applied Arts	Jane Addams Graduate School of Social Work
Graduate College	College of Veterinary Medicine

About matters of finance, loan funds, part-time employment, student use of motor vehicles, or other questions involving student welfare and campus life, write or talk to the

DEAN OF STUDENTS

University of Illinois, 310 Student Services Building, Champaign 61820

About matters of housing, write or call at the office of the

HOUSING DIVISION

University of Illinois, 420 Student Services Building, Champaign 61820

About matters concerning services and facilities for permanently physically handicapped students, write to

DIVISION OF REHABILITATION-EDUCATION SERVICES

University of Illinois, Oak Street and Stadium Drive, Champaign 61820

About matters concerning a veteran's educational status and plans, write to

VETERANS EDUCATIONAL BENEFITS

University of Illinois, Room 109, 707 South Sixth Street, Champaign 61820

About matters especially referring to the Chicago Circle campus, including a catalog, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS

University of Illinois at Chicago Circle, Chicago

Mailing Address: P.O. Box 4348, Chicago, Illinois 60680

About matters especially referring to the University of Illinois at the Medical Center, including the publications of the Colleges of Dentistry, Medicine, Nursing, and Pharmacy, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS

University of Illinois at the Medical Center, 1853 West Polk Street, Chicago

Mailing Address: P.O. Box 6998, Chicago, Illinois 60680

For matters concerning a particular college, school, institute, or bureau which cannot be answered by one of the publications or sources listed above, write or talk to the dean or director of the unit in question.



Courses **Catalog**

UNIVERSITY OF ILLINOIS BULLETIN

UNIVERSITY OF ILLINOIS BULLETIN

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It is the policy of the University of Illinois to afford equal educational opportunities to qualified persons regardless of race, religion, sex, or ethnic background.

1974-76
Courses Catalog

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



Courses Catalog

The following list of courses is arranged in alphabetical order by departments, and in numerical order within the departments. Courses for undergraduates (freshmen and sophomores) are numbered 100 through 199; for advanced undergraduates (juniors and seniors), 200 through 299; for advanced undergraduates and graduates (juniors, seniors, and graduates), 300 through 399; for graduate students only, 400 and above. An undergraduate must have thirty hours to be classified as a sophomore, a minimum of sixty hours to be classified as a junior, and a minimum of ninety hours to be classified as a senior.

Following the title of each course is a brief description of the content, the credit given, and the requirements for admission to the course, if any. Special requirements for admission to certain courses are introduced by the word prerequisite. Most, but not all, of these courses are offered at least once during the academic year.

Each department has available the undergraduate course number 199, an undergraduate open seminar. This is a special course for independent study or for experimentation, or a seminar on topics not treated by regularly scheduled courses. Requests for initiation of the course and suggestions of areas of study may be made by students; the course may also be initiated by a faculty member. The seminar may be offered with approval of the faculty member involved and the department head. Credit for the course shall apply toward graduation; credit toward satisfying particular college or departmental requirement is contingent upon approval by the appropriate college or departmental committee.

Credit for undergraduate students is counted in semester hours. A semester hour represents the work of one classroom period for fifty minutes each week through one semester (two periods per week in an eight-week summer session), or the equivalent in laboratory or field work or approved independent study. In description of courses, "3 hours" means three hours of credit each semester or summer session.

Credit for graduate students taking courses numbered 300 and above usually is counted in units. One unit is considered the equivalent of four semester hours of credit.

Undergraduate students wishing to enroll in courses numbered 300 and above for graduate credit or in 400-level courses for undergraduate credit must obtain the advance approval of the Graduate College.

Each undergraduate student is expected to pursue a normal program of studies; the number of hours required varies with the college and the curriculum. More or less than a normal program may be permitted only by the dean of the student's college or his representative. To be eligible for Dean's List recognition, a student must complete successfully *fourteen academic hours* excluding credits earned through proficiency examinations, and credits earned through advanced placement tests. Course work taken on a pass-fail or S/U basis will be counted toward the fourteen hours required only if a passing grade is received. Courses for which grades are officially excused or deferred may be included in the fourteen minimum hours. (Except students in the College of Liberal Arts and Sciences; please see *Undergraduate Programs 1973-75*, page 277.) To be eligible for participation in specified undergraduate student activities, the student must carry twelve hours in a semester. Twelve credit hours and above (three units and above) in a semester comprise a full program of study for tuition and fees assessment; in an eight-week summer session the number of hours is six semester hours and above (one and one-half units and above).

The minimum program required for receipt of maximum educational benefit payments under the Veterans Readjustment Benefits Act of 1966 and for receipt of social security benefits as a dependent is twelve hours (or three units) in a semester and six hours (or one and one-half units) in an eight-week summer session.

Detailed information relating to admission, costs, and graduation requirements is given in the *Undergraduate Programs* and *Graduate Programs* catalogs. (See back inside cover for additional sources of information.)

ACCOUNTANCY

Head of Department: Professor E. J. DeMaris

Department Office: 360 Commerce Building (West), Urbana

101. **Principles of Accounting, I.** Basic accounting and business concepts; principles of recording business transactions; cash records and control; periodic adjustment of transaction data; financial statement presentations; and relationship of accounting to business. Prerequisite: Sophomore standing. 3 hours.
105. **Principles of Accounting, II.** Accounting and reporting principles of partnerships, corporations, branches, departments, and enterprises with incomplete records; interpretation of financial statements; basic valuation and cost concepts; and control of manufacturing costs through product costing, process costing, standard costs, and budgeting. Prerequisite: Accountancy 101; sophomore standing. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Fundamentals of Accounting.** A survey course in the principles of accounting for non-commerce students. 3 hours.
203. **Business and Accounting Methods.** For students in professional curricula who will be confronted with accounting, tax, and business problems in connection with an independent practice. Not open to commerce students. Prerequisite: Junior standing. 2 hours.
206. **Cost Accounting for Engineers.** The elements of manufacturing costs and the influence of such costs and other accounting factors upon engineering design and production processes; correlation of engineering and accounting concepts and procedures. Not open to students who have credit in Accountancy 101 or 201. Prerequisite: Junior standing in engineering. 3 hours.
208. **Intermediate Accounting.** Accounting theory and concepts with an analysis of the special problems that arise in applying these underlying concepts to financial accounting; emphasis given to the use of accounting information as a basis for decisions by management, stockholders, creditors, and other users of financial statements and accounting reports. Prerequisite: Accountancy 101 and 105. 4 hours.
218. **Elementary and Intermediate Accounting.** An accelerated course designed for students with advanced standing and no prior preparation in accounting who desire to major in accountancy; fundamentals of proprietorship, partnership, and corporation accounting; consideration at the intermediate level of modern basic concepts of accounting theory; and interpretation of financial statements and analysis of the principal accounts represented therein. Prerequisite: Junior standing; general University grade-point average of 3.5 or consent of head of department. 5 hours.
221. **Current Accounting Topics.** Consideration of authoritative pronouncements dealing with controversial problems of accounting practice. Prerequisite: Accountancy 376. 2 hours.
266. **Cost Accounting.** Use of costs for control and decision making, with emphasis on standard costs, relevant costs, direct costing, nonmanufacturing costs, and responsibility accounting; for students who have already studied the basic elements of job order, process costs, and budgeting. Prerequisite: Accountancy 101 and 105. 3 hours.
274. **Basic Federal Income Tax Accounting.** Basic discussion of history, theory, and broad outlines of federal income taxation for individuals, partnerships, and corporations, including the more important basic concepts involved in federal income taxation. Prerequisite: Accountancy 105. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the

- honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
325. **Accounting System Design.** Introduction to the fundamentals of accounting system design including the design and use of business papers, records, and reports; the functions of business machines in accounting systems; and personnel problems in accounting system design. Prerequisite: Accountancy 266; Computer Science 105 or equivalent. 3 hours or $\frac{3}{4}$ unit.
341. **Governmental Accounting.** Accounts of institutions, of municipalities, and of state and federal governments; organization, procedure, budget, accounts and records, reports, and audits. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
362. **Business Budgets and Accounting Control.** Procedures used in the preparation of business budgets and the principles underlying these procedures; a complete budget is prepared by the student for a typical manufacturing company. Prerequisite: Nine hours of accountancy, including Accountancy 266. 3 hours or $\frac{3}{4}$ unit.
366. **Managerial Accounting and Quantitative Techniques.** Application of quantitative and mathematical techniques to managerial accounting problems including empirical methods, network techniques, probabilistic methods, linear algebra, sensitivity analysis, and other methods. Prerequisite: Accountancy 266; Economics 172; Mathematics 124. 3 hours or $\frac{3}{4}$ unit.
367. **Managerial Accounting and Organizational Controls.** A study of managerial accounting and its functioning as an information subsystem, in relationship to the system of organization and the attainment of the goals of the enterprise; stresses the interactions of the components of the enterprise in response to information generated by the managerial accountant. Prerequisite: Accountancy 266; senior standing. 3 hours or $\frac{3}{4}$ unit.
371. **Auditing.** Nature of audit evidence; basic audit techniques; audit practices and procedures; professional ethics; and audit reports. Prerequisite: Accountancy 376. 3 hours or $\frac{3}{4}$ unit.
372. **Auditing Problems and Cases.** Application of auditing principles in verification of financial statements; preparation of reports; case studies applicable to specific industries; and current trends. Prerequisite: Accountancy 371. 3 hours or $\frac{3}{4}$ unit.
374. **Advanced Income Tax Problems.** Practical and theoretical training in the more common and important provisions of the federal income tax, advanced problems, and tax case research and preparation. Prerequisite: Senior standing; Accountancy 274 and 376. 3 hours or $\frac{3}{4}$ unit.
376. **Advanced Accounting.** General theory; accounting applications of compound interest; accounting for price level changes; partnerships; fiduciaries; and recent developments in accounting theory and practice. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
377. **Advanced Problems.** Consolidated statements; branch accounting; business combinations; foreign exchange; business reorganizations; and recent developments in theory and practice. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
378. **Advanced Theory and Practice.** Selected problems from CPA examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; and theory, auditing, and ethics. Prerequisite: Accountancy 377. 3 hours or 1 unit.
432. **Accounting Under Different Social Systems.** An inquiry into the ways accounting has been adapted to the needs of different social systems; the extent of its contribution; and its apparent limitations. Consideration is also given to the relationship between accounting and the growth and development of social systems. Prerequisite: Consent of instructor. 1 unit.
441. **State and Federal Accounting Theory.** Advanced study in accounting and other fiscal procedures of the federal government; state, county, and municipal governments; and institutions. 1 unit.
450. **International Accounting Theory and Practice.** Accounting methods and procedures, theories and thoughts of several countries analyzed and evaluated on a comparative basis; different approaches and solutions to similar accounting problems related to in-

fluences of tradition, environment, political ideas, etc.; special attention given to financial and managerial accounting problems of multinational corporations. Prerequisite: Undergraduate major in accounting or consent of instructor. 1 unit.

455. **Macroaccounting.** Same as Economics 425. An examination of the fundamental concepts underlying the attempts to measure the economic activities of macro units; similarities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macroaccounting statements and analyses; and usefulness of macroaccounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macroeconomic theory or consent of instructor. 1 unit.
461. **Administrative Accounting.** Accounting as a tool for management: organization of accounting department, coordination of departmental operations, control of assets, control of operations, management audits, accounting aspects of coordinating the business with market conditions, cooperation with public accountants and government agencies, and social responsibilities. 1 unit.
462. **Management Accounting.** An examination of recent conceptual and analytical developments in the area of management accounting; includes a study of modern and relevant planning and control techniques and their underlying concepts as applied to the various functional areas within the firm. Prerequisite: An undergraduate course in management accounting. The student's background in statistics and mathematics should be equivalent to the undergraduate requirements of the University of Illinois College of Commerce and Business Administration in these areas. 1 unit.
466. **Cost Accounting Theory and Analysis.** A critical examination of cost-accounting methods as to truth and expediency. 1 unit.
472. **Auditing Standards and Techniques.** A critical analysis of the techniques used in auditing; interrelation of audit standards, procedures, principles, and techniques; internal control as related to audit techniques; and trends and developments in the accounting profession. 1 unit.
473. **The Theory of Accounting System Design.** Problems and procedures in connection with designing and installing accounting systems. 1 unit.
474. **Income Tax Development.** A theoretical and historical approach to the study of the development of federal income taxation, together with some research on tax cases and critical appraisal of the current law and proposals for its revision. 1 unit.
481. **Concepts and Principles.** The fundamental structure of accounting theory developed through the study of concepts characteristic of accounting and an examination of the literature dealing with the concise formulation of accounting principles. 1 unit.
483. **Income Determination.** A study of the pros and cons of various unsettled issues involved in the calculation and disclosure of enterprise periodic income. 1 unit.
485. **Relationship of Accounting Theory to Philosophy, Science, and Other Disciplines.** An examination of the relationship of accounting theory to the developments, thoughts, and methods in the fundamental intellectual disciplines. 1 unit.
489. **History of Accounting Theory.** An examination of the more important aspects of accounting theory under the impact of changing conditions over four centuries, with major emphasis on the later developments. 1 unit.
493. **Special Research Problems.** Individual investigations or research projects selected by the students, subject to approval by the graduate adviser and the executive officer of the department. $\frac{1}{4}$ to 2 units.
499. **Thesis Research.** Individual direction and guidance in writing theses; seminar discussion of progress made. 0 to 4 units.
501. **Accounting Analysis, I.** Uses of accounting information; collection, processing, and communication of accounting information; measurement of assets, liabilities, equities, and income; and accounting system design. $\frac{3}{4}$ unit.
502. **Accounting Analysis, II.** An in-depth study of accounting valuation processes and accounting income measurement; special reporting problems of multiple-entity organiza-

- tions; and accounting for nonprofit organizations. Prerequisite: Accountancy 501 or equivalent. $\frac{3}{4}$ unit.
503. **Managerial Accounting.** Introduction to management accounting as part of the firm's information system, in terms of modern cost accounting and budgetary systems for planning and controlling business operations. Prerequisite: Credit or registration in Accountancy 501 or equivalent. 1 unit.
504. **Taxation and Auditing.** Introduction to historical and conceptual material in specialized accounting areas of taxation and auditing; emphasis centered on provisions of the tax law relevant to accounting measurement methods and on nature of evidence in auditing, auditing standards and techniques, and ethical constraints imposed on the auditor. Prerequisite: Accountancy 501 or 503, or equivalent. 1 unit.
566. **Accounting Problems of Industrial Management.** Development of the role and importance of accounting data in conjunction with modern quantitative methods in the process of industrial enterprise administration; attention focused on the use of existing accounting data in models and the demands on data accuracy and reliability as well as the necessity to develop additional data for the purpose of facilitating integrated planning, budgeting, and control processes. 1 unit.
577. **Professional Problems.** Instruction as to types and methods of solution of professional problems in public accounting, including practice in analyzing and solving a wide variety of such problems. For Master of Accounting Science students only. 1 unit.
594. **Methods and Practices in Professional Research.** Instruction in research methods, materials, and techniques together with individual practice in conducting and reporting specific professional research projects. For Master of Accounting Science students only. 1 unit.

ADVERTISING

Head of Department: Professor S. W. Dunn
Department Office: 103a Gregory Hall, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
281. **Introduction to Advertising.** A survey of the economics, psychology, and philosophy of advertising; preparation of advertisements; selection of media; and organizational structure. 3 hours.
288. **Sales Writing.** Same as Business and Technical Writing 271. Direct mail campaigns and company magazine copy. Prerequisite: Completion of campus rhetoric requirement or equivalent. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in advertising for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours.
309. **Public Relations.** Publicity methods and public relations; representation of profit and nonprofit institutions to the public; use of communications research and media; and preparation of public relations campaigns. Prerequisite: Senior standing in the College of Communications; consent of department. 3 hours or $\frac{1}{2}$ unit.
381. **Advertising Research Methods.** Quantitative techniques and research methodology in advertising: philosophy of science, statistical methods, survey and experimental design, etc; emphasis on the problems of advertising research. Prerequisite: Advertising 281; a basic course in statistical methods; consent of department. 3 hours or $\frac{1}{2}$ unit.
382. **Advertising Creative Strategy.** Theory and practice of advertising message planning and creation for print and broadcast media; use of consumer and market surveys, copy-testing methods, and advertising readership studies. Prerequisite: Advertising 281; consent of department. 3 hours or $\frac{1}{2}$ unit.

383. **Advertising Media Policy and Strategy.** Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. Prerequisite: Advertising 281; consent of department. 3 hours or ½ unit.
384. **Advertising Campaigns.** Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget; organization and functions of the advertising agency; choice of advertising appeals; selection of media; and preparation of advertisements (copy and layout). Prerequisite: Advertising 381, 382, and 383; consent of department. 3 hours or ½ unit.
387. **Advertising and Promotion Management.** Analysis of actual advertising situations and study of how such situations were or might have been met; emphasis is given to management decision-making problems at the national level. Prerequisite: Advertising 381, 382, and 383; consent of department. 3 hours or ½ unit.
388. **Advertising in Contemporary Society.** A study of advertising as an institution and its role in communications, society, our economy, and business. Graduate credit is not given for both Advertising 388 and 481. Prerequisite: Advertising 281; senior standing; consent of department. 3 hours or ½ unit.
389. **International Advertising and Promotion.** The role of advertising and promotion in international communication and economic development; behavioral science approach to international communication strategy; and comparative analysis of advertising and promotion systems. Prerequisite: Advertising 281; senior standing; consent of department. 3 hours, or ½ or 1 unit.
390. **Advanced Creative Strategy.** Advanced work in application of behavioral science and creative process to planning and writing of advertisements. Prerequisite: Advertising 382; consent of department. 2 hours, or ½ or 1 unit.
481. **Economic and Social Aspects of Advertising.** Same as Communications 481. An examination of advertising as an institution; the economic, social, and legal aspects of advertising with focus on current problems. Graduate credit is not given for both Advertising 481 and 388. 1 unit.
482. **Research Methods in Advertising and Communications.** Same as Communications 482. A treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications; examination of both nonquantitative and quantitative methods. Prerequisite: A basic course in statistical methods; consent of department. 1 unit.
483. **Advertising as Communication.** Advertising messages from the perspective of communication and mass communication theories; application of theory to advertising communication problems. 1 unit.
484. **Advertising and Consumer Behavior.** An examination of consumer behavior as a means of shaping the communications message; use of the behavioral sciences in creative communication strategy. Prerequisite: Consent of department. 1 unit.
485. **Advertising Planning and Decision Making.** Same as Communications 485. An examination of the theoretical foundations of decision theory as they relate to planning and decision making in advertising; use of decision models in the development of strategies and tactics. 1 unit.
490. **Special Topics in Advertising.** Prerequisite: Consent of department. ½ or 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in advertising. 1 to 2 units.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

Head of Department: Professor H. S. Stillwell

Department Office: 101 Transportation Building, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
212. **Aerodynamics, I.** Quasi-one-dimensional flow; conservation of mass, momentum, and energy; steady flow with variable area; steady, constant area flow with friction, heat addition, and mass injection; shock waves; nonsteady, one-dimensional flows; and two-dimensional flow, oblique shock waves, and Prandtl-Meyer waves. Prerequisite: Mechanical Engineering 207; Theoretical and Applied Mechanics 156; credit or concurrent registration in Mathematics 343. 4 hours.
213. **Aerodynamics, II.** Equations of motion for a viscous, heat-conducting fluid; exact solutions of the Navier-Stokes' equations; boundary layer theory; inviscid approximations, vorticity, and circulation; potential flow; solutions of potential flow equations, sources, sinks, and Prandtl-Meyer flow; thin airfoil and slender body theory; and method of characteristics. Prerequisite: Aeronautical and Astronautical Engineering 212. 4 hours.
224. **Flight Structures, I.** Development of fundamental concepts of elasticity as related to stress, strain, equilibrium, compatibility, and material properties; applications to flight vehicle structural problems in unsymmetric bending, torsion, thick-walled cylinders, rotating discs, shear flow, and shear center problems. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 156. 4 hours.
225. **Flight Structures, II.** Energy concepts with applications to indeterminate flight structures, sandwich beams, and shear flow; elastic and plastic buckling of columns and plates; and membrane theory of shells. Prerequisite: Aeronautical and Astronautical Engineering 224. 4 hours.
233. **Aircraft Propulsion.** Study of current and projected aircraft power plants and propulsion systems from the standpoint of operation, efficiencies, and construction; fuels and fuel systems; ignition; combustion; and air compression. Prerequisite: Aeronautical and Astronautical Engineering 212. 3 hours.
241. **Flight Vehicle Design.** Introduction to preliminary design of airplanes, missiles, and space vehicles; further development of concepts in orbital mechanics, hypersonic aerodynamics, and aerodynamic heating. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255; Computer Science 101. 3 hours.
254. **Aerospace Dynamic Systems, I.** Aerospace system components and block diagrams; single degree-of-freedom dynamic and linear feedback control systems; Laplace transforms, time domain, and frequency response techniques; the characteristic equation and stability criteria; and introduction to inertial guidance and analog computers. Prerequisite: Mathematics 345 or 349. 3 hours.
255. **Aerospace Dynamic Systems, II.** Hamilton's principle and Lagrange's equation; fundamentals of orbital mechanics and trajectory optimization; multiple degrees of freedom; dynamic systems and continuous elastic structures; divergence and flutter of lifting surfaces; flight vehicle performance, stability, and control; and large disturbance maneuvers. Prerequisite: Aeronautical and Astronautical Engineering 254. 4 hours.
260. **Aerospace Laboratory, I.** Theory and application of experimental techniques in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255. 2 hours.
263. **Aerospace Laboratory, II.** Design of experiments and application of the various measurement techniques to investigations in aeronautical and astronautical engineering. Special projects may be undertaken by selected students. Prerequisite: Aeronautical and Astronautical Engineering 260. 2 hours.
271. **Principles of Automatic Control.** Steady-state and dynamic properties of servomechanisms and feedback control systems; block diagrams and system equations; Laplace transforms; frequency-response techniques; the characteristic equation, stability crite-

- ria, and compensation techniques; and introduction to analog computers and inertial navigation. Prerequisite: Mathematics 345 or 349. 3 hours.
292. **Seminar.** Reports and discussions of recent developments in the fields of aerodynamics, flight mechanics, power plants, structures, and maintenance and operations as related to airplanes, missiles, and space vehicles. Prerequisite: Senior standing. 1 hour.
296. **Honors Project.** Same as Electrical Engineering, Industrial Engineering, and Mechanical Engineering 296. A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Same as Electrical Engineering, Industrial Engineering, and Mechanical Engineering 297. Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
303. **The Effect of Space Environment on Satellite Motion.** Free molecule aerodynamics; gravity gradient and solar radiation torques on satellites; interaction of on-board magnetic dipoles with the earth's magnetic field; solar wind; cosmic dust and micrometeoroid torques; lifetime problem and density determination; and utilization of these various environmental effects in satellite attitude control. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **Foundations of Mechanics and Gravitational Theory.** Same as Astronomy 306. Introduction to the dynamics of particles and of rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectiles relative to earth, and precession of earth's axis. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
311. **Aerodynamics of Compressible Fluids.** Methods of solution of fluid flow problems in subsonic, transonic, and supersonic flight regimes. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
313. **Aerodynamics of Incompressible Fluids.** Governing equations for incompressible flow; vorticity, circulation, and Kelvin's, and Helmholtz's theorems; velocity potential and stream function; three-dimensional steady and nonsteady flows, d'Alembert's paradox, and apparent mass; two-dimensional steady flows, complex potential and velocity, and mapping of flows; two-dimensional airfoils and Joukowski transformation and airfoils; and thin airfoil theory. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
314. **Aerodynamic Heat Transfer.** Thermal boundary layers; turbulent heat transfer; aerodynamic heating; and radiative heat transfer. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
316. **Applied Aerodynamics.** Two-dimensional and finite wing theory with emphasis on the mechanisms of lift and drag generation; Reynolds number and Mach number effects; drag analysis; high-lift wing systems; propeller and rotor aerodynamics; control surface design; and application of V/STOL aerodynamics. Prerequisite: Aeronautical and Astronautical Engineering 213 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
317. **Elements of Magnetohydrodynamics.** Same as Astronomy 317. Equations of magnetohydrodynamics; single-fluid and multiple-fluid models; magnetic interaction parameters; magnetosonic waves; hydromagnetic shock waves; aligned-field and crossed-field flows; theory of characteristics; MHD acceleration generation; and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit.
326. **Theory of Continuous Media.** Introduction to the general theory of continuous media and its application to the theories of elasticity, fluid mechanics, and inelasticity; stress and strain tensors and their invariants; nonlinear equilibrium conditions; the mechanism of deformation of single crystal and polycrystalline media; basic concepts of the structure of matter; thermodynamic considerations; and equations of state and stress-strain relationships with applications. Prerequisite: Consent of instructor. 3 hours or 1 unit.

- 331. Properties of Gases.** The fundamental principles of kinetic theory and of classical and statistical thermodynamics are reviewed as a basis for treating gas imperfection, dissociation, chemical reactions, ionization processes, transport properties, and relaxation phenomena. With this base, the fundamental equations of reactive flow are derived and applied to the description of quasi-one-dimensional nozzle flow and shock wave structure. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours or $\frac{3}{4}$ unit.
- 333. Electric Propulsion.** Elements of propulsion as applied to deep space missions; physics of ionized gases; plasmadynamics; electrothermal, electromagnetic, and electrostatic acceleration of gases to high velocity; high-impulse thruster design and performance; and the resistojet, arcjet, ion engine, MPD arc, and plasma gun. 3 hours or 1 unit.
- 334. Rocket Propulsion and Rocketry.** The basic principles of rocket propulsion and rocketry are treated; propellants and their influence on design of rockets, internal and external ballistics, combustion processes, design of components, guidance problems, flight performance, and rocket testing are discussed in detail. Prerequisite: First course in thermodynamics or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 351. Aeroelasticity and Aeroinelasticity.** Advanced fundamental treatment of aerodynamic and dynamic structural phenomena associated with flexible airplanes and missiles; divergence of linear and nonlinear elastic lifting surfaces; effect of elastic and inelastic deformations on lift distributions and stability; elastic flutter of straight and swept wings; equations of disturbed motion of elastic and inelastic aircraft; dynamic response to forces, gusts, and continuous atmospheric turbulence; creep divergence of lifting surfaces; flutter in the presence of creep; and effect of temperature on inelastic divergence and flutter. Prerequisite: Aeronautical and Astronautical Engineering 255. 3 hours or 1 unit.
- 391. Special Problems.** Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. Prerequisite: Senior standing in engineering; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit.
- 414. Boundary Layer Theory.** Theories of the boundary layer of a compressible fluid and their solutions, laminar and turbulent; boundary layer in hypersonic flows. Prerequisite: Aeronautical and Astronautical Engineering 213. 1 unit.
- 415. Wing Theory.** Theoretical analysis of the aerodynamic characteristics of two- and three-dimensional wings and multiple-body systems in subsonic and supersonic flows. Prerequisite: Mathematics 346 or equivalent. 1 unit.
- 417. Fundamentals of Gas Kinetics.** Fundamental concepts required to study gas dynamic problems from the viewpoint of kinetic theory; derivation of the Boltzmann equation from classical mechanics; reduced and truncated distribution functions and the BBGKY hierarchy; molecular collisions; flux vectors and equations of change; moment equations; summational invariants; H-theorem and Maxwellian distribution; inclusion of the effect of solid surfaces in kinetic theory; existence theory for the Boltzmann equation; iteration procedures; moment methods; Chapman-Enskog procedure; and first and second approximations to the distribution function, heat flux vector, and stress tensor. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 1 unit.
- 418. Theory of Rarefied Gas Flows.** Application of kinetic theory to rarefied gas flow problems; free-molecule flow; near free-molecule flow; linearized problems; and flows with appreciable deviation from equilibrium. Prerequisite: Aeronautical and Astronautical Engineering 417 or Physics 362. 1 unit.
- 428. Theory of Large Deformations in Nonlinear Continuous Media.** Fundamental concepts of large deformations in nonlinear elasticity and inelasticity with applications: generalized tensors, finite deformations, stress-strain relations in terms of strain energy functions, solutions of tension, shear and bending problems, finite plane strain, theory of successive approximations, fiber-reinforced beams, plates and cylinders, thermodynamics of deformable media, stability considerations, and constituent relations for in-

lasticity. Prerequisite: Aeronautical and Astronautical Engineering 326 or equivalent. 1 unit.

- 429. Theory of Linear and Nonlinear Viscoelasticity.** Same as Theoretical and Applied Mechanics 429. Fundamental concepts of viscoelasticity with applications: elastic-viscoelastic analogies, creep and relaxation functions, thermomechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, and torsion of nonlinear bars and shells. Prerequisite: Aeronautical and Astronautical Engineering 326 or consent of instructor. 1 unit.
- 434. Aerodynamic Heating.** Theory of convective aerodynamic heating in high-speed flow and laminar and turbulent flows; ablation, transpiration cooling, and mass transfer cooling; aerodynamic heating in hypersonic flow, real gas effects, and effect of pressure interactions and vorticity interactions; and heat transfer in rarefied gas flows. Prerequisite: Aeronautical and Astronautical Engineering 414 or equivalent. 1 unit.
- 438. Fundamentals of Combustion.** Same as Mechanical Engineering 403. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames, their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; and supersonic burning. Prerequisite: Aeronautical and Astronautical Engineering 213 or Mechanical Engineering 305. 1 unit.
- 452. Stochastic Structural Dynamics.** Same as Theoretical and Applied Mechanics 417. Structural dynamics problems treated from a probabilistic point of view; theory of probability and random processes introduced as mathematical tools; response of structures under random excitation is studied in order of increasing complexity; and probability of failure for such structures is discussed. Prerequisite: Aeronautical and Astronautical Engineering 355, Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
- 453. Aerodynamic Noise.** Same as Theoretical and Applied Mechanics 418. Mathematical techniques for the analysis of intensity, spectrum, and directivity of noise field in various environments; practical examples including jet and rocket engines, propeller and fan, sonic boom, and cabin noise of high speed vehicles. Prerequisite: Graduate standing in engineering, physics, or mathematics. 1 unit.
- 490. Seminar.** Presentation by graduate students and staff of current topics in the field of aeronautics. Prerequisite: Graduate standing in aeronautical and astronautical engineering. 0 credit.
- 493. Special Problems.** Theoretical and experimental investigations of problems in airplane, missile, and space flight engineering. 1 to 2 units.
- 499. Thesis Research.** Research in the various areas of the aeronautical and astronautical engineering sciences. 0 to 4 units.

AFRICAN STUDIES

Chairman of Program: Professor V. C. Uchendu

Program Office: Room 101, 1208 West California Avenue, Urbana

- 201. Elementary Swahili, I.** Same as Swahili 201. Beginning spoken Swahili with minimum of formal grammar; conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.

202. **Elementary Swahili, II.** Same as Swahili 202. Second semester of spoken Swahili; more conversation with a native tutor; and further grammar. Prerequisite: African Studies 201. 5 hours.
205. **Elementary Yoruba, I.** Same as Yoruba 201. An introduction to Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; essentials of formal grammar. All students are required to register for three hours per week in the language laboratory. 5 hours.
206. **Elementary Yoruba, II.** Same as Yoruba 202. Second term of spoken Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; further formal grammar based on conversational materials. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 205 or consent of instructor. 5 hours.
222. **Introduction to Modern Africa.** Same as Anthropology, Political Science, and Sociology 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
303. **Intermediate Swahili, I.** Same as Swahili 303. Second-year Swahili with emphasis on developing conversational fluency; some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as Swahili 304. More of second-year Swahili with emphasis on conversational fluency; some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.
307. **Intermediate Yoruba, I.** Same as Yoruba 303. Continued study of Yoruba grammar with emphasis on developing conversational fluency; readings on Yoruban culture and current affairs. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 206 or consent of instructor. 5 hours or 1 unit.
308. **Intermediate Yoruba, II.** Same as Yoruba 304. Concentrates on attaining conversational fluency; further readings in Yoruban newspapers and magazines and simpler portions from contemporary Yoruban plays and novels. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 307 or consent of instructor. 5 hours or 1 unit.

AGRICULTURAL COMMUNICATIONS

Acting Head of Department: Professor E. W. Vernon

Department Office: 62 Mumford Hall, Urbana

106. **Functional Writing, I.** Instruction and practice in functional writing related to unique interests of students in the College of Agriculture; designed primarily to be taken with freshman rhetoric by students with special needs for improvement in their use of English. Restricted to students in the College of Agriculture. 1 to 2 hours.
107. **Functional Writing, II.** Continuation of Agricultural Communications 106. Prerequisite: Agricultural Communications 106 or consent of instructor. 1 to 2 hours.
114. **Agricultural Communications Media and Methods.** Same as Journalism 114. Introduction to print, broadcast, visual, and other major communications media used to convey agricultural information; development of basic skills in communicating through those media. Prerequisite: Completion of rhetoric requirement. 3 hours.
214. **Agricultural Communications Strategy.** Same as Journalism 214. Coordinated approach to planning and carrying out programs of agricultural information and education using a variety of communications media; students apply principles of strategy to actual communications problems of their choice. Prerequisite: Agricultural Communications 114 or consent of instructor. 3 hours.

240. **Photography in Agriculture.** Application of visual communications principles to agriculture using the photograph as medium; emphasizes communicative, creative, and technical aspects. Materials cost approximately \$25.00. Prerequisite: Agricultural Communications 214; consent of instructor. 3 hours.
300. **Special Problems in Agricultural Communications.** Special projects, research, and independent study in agricultural communications. Prerequisite: Agricultural Communications 114 or equivalent; written consent of instructor and authorized departmental approval prior to advance enrollment and registration; not open to students on probation. Specific approval of the associate dean is required in advance of registration for a second and/or third special problems course. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.
320. **Agriculture and Its Publics.** Communications analysis of major interactions between agriculture and other segments of American society. Prerequisite: Nine hours of social science. 3 hours or $\frac{3}{4}$ unit.
460. **Teaching of College-Level Agriculture.** Analysis and preparation for the problems encountered in the effective teaching of college-level agriculture and home economics; systems approach, including instructional objectives, preassessment of students, instructional strategies, materials, and student performance evaluation; and detailed study of individual problems supplements class work. Prerequisite: Master's standing. $\frac{1}{2}$ unit.
461. **Extension Communications Management.** Analysis and management of effective extension communications based on present communication and educational concepts. 1 unit.

AGRICULTURAL ECONOMICS

(Including Rural Sociology)

Head of Department: Professor R. L. Feltner

Department Office: 305 Mumford Hall, Urbana

Agricultural Economics

100. **Introductory Agricultural Economics.** Principles of production, supply, and demand applied to economic problems of agriculture and agriculturally related industries and to decisions in farm management, marketing, foreign trade, and agricultural policy; the role in economic growth of natural resources, population, and capital. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Problems in Agricultural Economics.** Individual research work under the supervision of senior members of the staff in the following fields: agricultural credit and finance; agricultural law; agricultural marketing; agricultural policy; agricultural prices; farm management; land economics; rural organization; and statistical analysis. Students may receive credit for research in preparing for intercollegiate debating and speaking on problems in agricultural economics when such opportunities exist. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval are required prior to advance enrollment and registration. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
203. **Farm Taxation.** Federal, state, and local taxation with emphasis on their application to farm income, farm property, farm property transfers, and agricultural cooperatives; introductory material on the uses and sources of revenue. 2 hours.
220. **Farm Management.** Economic principles applied to management of farms; budgeting; crop and livestock systems; record analysis; financial management; farm leases; and

- problems in resource appraisal and business reorganization. Field trip required; estimated cost, \$2.00. Prerequisite: Agricultural Economics 100 or Economics 108. Three hours credit without home farm problem or 4 hours credit with home farm problem. 3 or 4 hours.
230. **Marketing of Agricultural Products.** Nature of the production, the marketing system, and the market for farm products; functions and services performed; and selected and general problems in pricing major commodities, in choosing outlets, and in expanding the market. Field trip; estimated cost, \$3.00 or less. 3 hours.
273. **Recreation in Rural Areas.** Same as Recreation 273. Growth and development of recreation in rural areas; leadership development; agencies; and types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, \$15.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours.
301. **Economics of Agricultural Development.** The economics of agricultural development and the relationships between agriculture and other sectors of the economy in developing nations; agricultural productivity and levels of living in the less developed areas of the world; and studies of agricultural development in different world regions including Africa, Asia, and Latin America. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **Financing Agriculture.** Capital and credit needs of farmers; agencies supplying credit; and problems of borrowers and lenders. Prerequisite: Economics 102 and 103, or 108. 3 hours, or $\frac{3}{4}$ or 1 unit.
303. **Agricultural Law.** Relation of common-law principles and statutory law to land tenure, farm tenancy, farm labor, farm management, taxation, and other problems involving agriculture. Prerequisite: Senior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
305. **Agricultural Policies and Programs.** The problems of agriculture as an industry; analysis of past and current federal and state governmental policies and programs affecting agriculture; objectives and development of policies; the use of economic concepts in evaluating possible future agricultural policies and programs; and forces in policy formation. Field trip; estimated cost, \$10.00. Prerequisite: Economics 108. 3 hours, or $\frac{3}{4}$ or 1 unit.
312. **Farm Appraisals.** Same as Agronomy 312. Valuation methods and value bases of farm real estate; legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agronomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, \$10.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, $\frac{3}{4}$ or 1 unit).
318. **Land Economics.** Physical, economic, and institutional factors that affect the role of land in economic life; population and resource requirements; principles of land utilization; returns from land; land value; property rights and tenure rights; social controls; and rural and urban land development. Prerequisite: For undergraduates, Economics 103 or 108; for graduates, consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
324. **Farm Operation.** Operating costs in farming; analysis of farm jobs; farm work simplification; and selecting power units and equipment for economical operation. Field trips; estimated cost, \$5.00. Prerequisite: Agricultural Economics 220. 3 hours, or $\frac{3}{4}$ or 1 unit.
325. **Advanced Farm Management.** The functions of management; effects of goals and values on management decision; use of economic analysis in farm production planning, including resource allocation and valuation; and cost minimization. Prerequisite: Agricultural Economics 220. 3 hours, or $\frac{3}{4}$ or 1 unit.
326. **Professional Farm Management.** Principles of farm management applied to the problems of those managing farms for others as a profession; development of the profession; relationships with clients and farm operators; division of inputs and returns between owner and operator; direct operation of farms with hired labor; case problems; business practices and procedures; and professional ethics. Field trips to farms and professional

farm management offices; estimated cost, \$25.00. Prerequisite: Credit or concurrent registration in Agricultural Economics 324; Agricultural Economics 325. 3 hours, or $\frac{3}{4}$ or 1 unit.

331. **Grain Marketing.** Economic and marketing problems in grain; the utilization of grain; pricing arrangements for grain, especially futures markets; inventory management; operational problems at country and interior points; factors affecting grain prices; and seasonal variation in grain prices. Field trips required; estimated cost, \$10.00. Prerequisite: Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Livestock Marketing.** Same as Animal Science 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; and evaluation of changes in the industry affecting marketing decisions. Field trip; estimated cost, \$15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
334. **Marketing of Dairy Products.** Same as Dairy Science 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, markup laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; and expanding markets for dairy products. Inspection trip; estimated cost, \$5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or 12 hours of dairy science or dairy technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Economics of Food Distribution.** Same as Horticulture 335. Analysis of (a) marketing structure and operation in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; and (c) consumer demand for food. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
337. **Economic History of American Agriculture.** Same as Economics 337 and History 337. The development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college-level course in basic economics or American history. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **Agribusiness Management.** Fundamentals in demand analysis, forecasting, budgeting, investing, locating facilities, financing, pricing, and merchandising in agricultural businesses; practice in decision making using computer games and case problems of firms. Prerequisite: Accountancy 101 or 201; Economics 102 or 108. 3 hours or $\frac{3}{4}$ unit.
340. **Commodity Futures Markets and Trading.** Development of futures trading; operation and governance of commodity exchanges; economic functions of futures trading; operational procedures and problems in using futures markets; public regulation of futures trading; and developmental problems. Field trips required; estimated cost, \$25.00. Prerequisite: Economics 103 or 108. 3 hours or $\frac{3}{4}$ unit.
341. **Agricultural Economic Statistics.** Graphic presentation; frequency distribution; inference and probability; time series analysis; index numbers; analysis of variance; correlation; and simple and multiple regression as applied to agricultural economics. Prerequisite: Mathematics 111 or 112, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
342. **Agricultural Prices.** A study of the factors affecting prices of agricultural products; longtime cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products; and problems in price analysis and forecasting. Prerequisite: Economics 102 and 103, or 108. 3 hours, or $\frac{3}{4}$ or 1 unit.
352. **Economic Development in Latin America.** Same as Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

353. **Economic Development in India and Southeast Asia.** Same as Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Economic Development of Tropical Africa.** Same as Economics 354. Types of African economies and growth of the exchange economy; development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental planning, and development projects; and demographic, land tenure, and institutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Family Economics.** Same as Home Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
401. **International Comparative Agriculture.** Agricultural and food problems of the world and of selected countries viewed in the world setting; resources and institutional factors affecting production; and national and international policies and plans for developing agricultural production and improving levels of living. Emphasis is given to a comparative approach to agricultural development of countries on different economic levels. 1 unit.
404. **Economics of Agricultural Production.** Evaluation of efficiency in the use of agricultural resources; production relationships within the farm; adaptation of the farm business to uncertainty; production relationship among farms; and location of agricultural production. Prerequisite: Economics 200 or 300; Agricultural Economics 341 or consent of instructor. 1 unit.
405. **Economic Policies and Programs Affecting Agriculture.** Economic analysis of state, national, and international policies and programs, including proposed legislation having important bearing on the well-being of farm people. Prerequisite: One semester of graduate work or consent of instructor. 1 unit.
406. **Research Methodology in Agricultural Economics.** Methods of inquiry leading to information which is reliable and relevant to the solution of problems significant in the agricultural economy. Prerequisite: Economics 400 or 401, or a course of comparable level in the basic field related to the student's research. 1 unit.
425. **Farm Management Principles.** Analysis of farm business records; evaluation of measures of efficiency; planning the cropping system for increased income and control of erosion; use of economic information in fitting livestock to the farm plan; efficient use of labor and power; and special research problems in farm organization. Field trip; estimated cost, \$8.00. 1 unit.
436. **Problems in Marketing Agricultural Products.** Factors influencing growth of markets; methods of reducing costs and improving marketing processes; activities of government agencies; and cooperative efforts. 1 unit.
441. **Agricultural Statistics.** Sources and methods of collection and analysis of prices and other agricultural statistics; trend fitting, linear and curvilinear multiple correlation, analysis of variance, and sampling. Prerequisite: An elementary course in statistics. 1 unit.
442. **Agricultural Price Analysis.** A study of the methods used to analyze factors affecting agricultural prices; analysis of agricultural prices and price movements with respect to time, space, and form; methods of price forecasting; and role of public and private institutions in price setting. Prerequisite: Economics 300 and Agricultural Economics 341, or equivalent. 1 unit.
470. **Seminar in Family and Consumption Economics.** Same as Home Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 102 or 108; a course in statistics; Agricultural Economics 370 or consent of instructor. $\frac{1}{2}$ or 1 unit.

- 491. Seminar and Special Topics.** All graduate students majoring in agricultural economics must register in the noncredit section of this course. In addition, students may register for credit for individual research or group instruction on special topics under the supervision of one or more staff members. 0 to 2 units.
- 499. Thesis Research.** Individual research under supervision of members of the graduate teaching staff in their respective fields. 0 to 4 units.

Rural Sociology

- 117. Introduction to Rural Sociology.** Principles of rural-urban sociology with examples and illustrations from rural society; basic concepts for analysis of sociological data on culture, ecology, population, groups, institutions, and social processes. Credit is not given for both Rural Sociology 117 and Sociology 100. 3 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 270. Population and Human Ecology.** Same as Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; and theories, human ecology, and current problems. Prerequisite: Sociology 100 or Rural Sociology 117; junior standing. 3 hours.
- 277. Rural Social Change.** Same as Sociology 277. Social forces retarding or accelerating change (traditions, beliefs, attitudes, innovations, social movements, and social planning) as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed \$5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.
- 343. Social Change in Developing Areas.** Same as Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies; special attention given to problems of traditional social structure undergoing modernization; and social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, family, and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 378. Sociocultural Factors in African Economic Development.** Same as Anthropology 378. An examination of the African development environment and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
- 407. Population Studies and Demographic Analysis.** Same as Sociology 407. Nature and development of population theories; population growth and measures of fertility, reproduction, mortality, morbidity, and internal migration; indices, rates, and standardizations used in analyzing compositional characteristics; methods in population projections; and relationship of economic, sociological, and psychological factors to population changes. Prerequisite: Twelve hours of social science and introductory statistics, or major in sociology, or consent of instructor. 1 unit.
- 477. Seminar on Community Organization.** Same as Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
- 487. Special Problems in Rural Sociology.** Same as Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. $\frac{1}{2}$ or 1 unit.

AGRICULTURAL ENGINEERING

(Including Agricultural Mechanization)

Head of Department: Professor F. B. Lanham

Department Office: 241 Agricultural Engineering Building, Urbana

Agricultural Engineering

126. **Engineering in Agriculture, I.** Consideration of the role of the agricultural engineer in the development of agricultural production facilities; resources for production; material and equipment performance characteristics; livestock production systems; and analysis of system constraints. Prerequisites: Mathematics 120; credit or concurrent registration in Physics 106. 3 hours.
127. **Engineering in Agriculture, II.** Continuation of Agricultural Engineering 126. Field equipment performance characteristics; analysis of machinery systems constraints; and elementary design of equipment systems using concepts of uncertainty, modeling, and optimization. Prerequisite: Agricultural Engineering 126. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 5 hours.
236. **Machine Characteristics and Mechanisms.** Design and development concepts of agricultural and industrial machines; analysis and synthesis of tillage, planting, harvesting, and material-handling mechanisms. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 212; credit or concurrent registration in Computer Science 101. 3 hours.
256. **Surveying Agricultural and Forest Lands.** Same as Forestry 256. Basic surveying procedures as applied to practices in soil and water conservation engineering and in forest management and engineering. Prerequisite: Mathematics 114. 2 hours.
277. **Design of Concrete and Steel Structures for Agriculture.** Design of steel and concrete structures as applied to farm buildings and soil and water engineering structures. Prerequisite: Credit or concurrent registration in Civil Engineering 261. 3 hours.
287. **Environmental Control for Plants and Animals.** Application of engineering and biological principles to the art and science of controlling environments for productive animals, plants, and their products. Methods for maintaining environments to meet specific biological requirements are investigated through the integration of engineering principles for environmental control with the thermodynamic properties of animals, plants, and their related biological needs. Prerequisite: Agricultural Engineering 126 and 127. 3 hours.
296. **Honors Project.** A special problem in engineering is selected for bibliographical, theoretical, and/or experimental research. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
298. **Undergraduate Seminar.** Professional engineering concepts; relationship of agricultural engineering to other engineering and agricultural disciplines; and preparation and presentation of an undergraduate thesis proposal. Thesis to be completed in Agricultural Engineering 299. Three-day field trip. Prerequisite: Junior standing in engineering. 1 hour.
299. **Undergraduate Thesis.** The agricultural engineering problem selected in Agricultural Engineering 298 is investigated and a detailed engineering report is prepared. Prerequisite: Agricultural Engineering 298; senior standing in engineering. 2 to 4 hours.
311. **Instrumentation and Measurements.** Same as Mechanical Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; and instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.

336. **Design of Agricultural Machinery.** Determining machine requirements and specifications, design layout, effective use of materials and shapes, and relation of design to problem. Prerequisite: Agricultural Engineering 236; credit or concurrent registration in Mechanical Engineering 224. 3 hours or $\frac{3}{4}$ unit.
340. **Introduction to Applied Statistics.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
346. **Tractors and Prime Movers.** Engineering aspects of design and application of tractors for farm, construction, and military use; thermodynamics of engines, turbines, and other power units; and measurement of power and efficiencies, transmission of power, traction, stability, and hydraulic circuitry. Prerequisite: Mechanical Engineering 209. 3 hours or $\frac{3}{4}$ unit.
348. **Air Pollution Seminar.** Same as Civil Engineering, General Engineering, Geography, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, economic damage, and the political, legal, urban planning, and engineering implications of air pollution as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or $\frac{1}{2}$ unit.
356. **Soil Conservation Structures.** Hydrology, hydraulics, design, construction, and cost estimating of soil and water conservation structures; relationship of slopes, soils, crops, and practices in soil conservation and flood control. Prerequisite: Theoretical and Applied Mechanics 235; Agricultural Engineering 277 or equivalent. 3 hours or $\frac{3}{4}$ unit.
357. **Land Drainage.** The design, construction, performance, and maintenance of surface tile and open-ditch drainage systems. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours or $\frac{3}{4}$ unit.
387. **Agricultural Process Engineering.** Principles, design factors, equipment, and controls of systems for drying, refrigerating, reducing, pelleting, blending, cleaning, sorting, and treating agricultural crops and products. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
396. **Special Problems.** Individual investigation and report of any phase of agricultural engineering approved by the department. Prerequisite: Senior standing in engineering. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
400. **Research Orientation.** Discussion of the philosophy and methods of research, thesis preparation, and publication of research findings. 0 credit.
436. **Dynamics of Farm Machine Elements.** Advanced study of the dynamics of farm machine elements with specific reference to functional operation, stresses, and fatigue life. Prerequisite: Agricultural Engineering 236 and 336, or equivalent. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Agricultural Engineering 340 or equivalent. $\frac{3}{4}$ unit.
441. **Advanced Design and Analysis of Biological Experiments.** Same as Agronomy 441. Design and analysis of complex experiments. Confounded factorials, lattice designs, and other incomplete-block experiments are considered from the viewpoint of their characteristics, methods of analysis, and usefulness in biological research. Prerequisite: Agricultural Engineering 440 or equivalent. $\frac{1}{2}$ unit.
446. **Dynamics of Tillage, Traction, and Earthmoving.** Relationship of soil parameters to forces acting on tillage tools, earthmoving components, and traction devices; stress-strain relationships in soil, failure patterns, and pulverization; and speed effects, energy

requirements, power trains, and model simulation. Prerequisite: Bachelor of Science degree in engineering or consent of instructor. 1 unit.

- 490. **Seminar.** Presentation and discussion of current research and literature in agricultural engineering. $\frac{1}{4}$ unit.
- 496. **Problems in Agricultural Engineering.** Investigation and report on problems in farm machinery, farm power, rural electrification, soil and water control, rural housing, and farm structures. Prerequisite: Consent of head of department. 1 unit.
- 499. **Thesis Research.** 0 to 4 units.

Agricultural Mechanization

- 100. **Engineering Applications in Agriculture.** Examples, problems, discussions, and laboratory exercises pointing to present and potential engineering applications in agriculture; emphasis on farm power and machinery, soil and water control, farm electrification, and farm structures. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 3 hours.
- 199. **Undergraduate Open Seminar.** 1 to 5 hours.
- 200. **Agricultural Mechanics Shop: Construction Technology.** Selection, use, and maintenance of hand and power tools; shop safety; selection of building and roofing materials; concrete and concrete masonry construction; crop and machinery storage; livestock housing; and farm leveling and erosion control structures. A special ten-week course for students majoring in vocational agriculture who are enrolled in off-campus student teaching. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours.
- 201. **Agricultural Mechanics Shop: Electrical and Metalwork.** Selection and application of electrical wiring, materials, controls, and electric motors to agricultural lighting, heating, ventilating, and materials-handling problems; metalworking, heat treating, and plumbing; and selection and use of electric arc, inert gas, acetylene, and spot welding. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours.
- 221. **Farm Power and Machinery Management.** Performance, costs, application, and selection of farm tractors and implements; selection of machinery systems. Prerequisite: Credit in Agricultural Mechanization 100 or, with consent of the instructor, concurrent registration in Agricultural Mechanization 100. 4 hours.
- 241. **Farm Tractor Power.** Construction and performance of internal combustion engines; power transmission, control, fuel, electrical systems, and hydraulic systems; and analysis of methods and equipment for performance testing. Prerequisite: Physics 101 recommended. 3 hours.
- 252. **Mechanics of Soil and Water Conservation.** Principles of planning, constructing, and adapting soil conservation and drainage practices for Illinois farms, and the application of surveying to these practices. Lectures, field work, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours.
- 272. **Farm Buildings.** Requirements of farm buildings; problem analysis and planning; building plans; materials; construction methods; and costs. Lectures, discussions, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours.
- 281. **Farmstead Mechanization.** Fundamental electric laws; planning electric wiring systems; single-phase motor selection, care, and application; and an introductory study of principles and planning required for materials-handling systems, drying, water pumps and systems, and lighting and ventilation in agricultural production. Prerequisite: Agricultural Mechanization 100 or 201. 3 hours.
- 299. **Agricultural Mechanization Seminar.** The role of the mechanization of agriculture in society and the part of the individual graduate in this role; directed toward the study of the interplay of developments in agriculture and agricultural mechanization; topics se-

lected from technical and popular journals. A tour of farms, industry, and business is required; estimated cost, \$30.00. Prerequisite: Junior standing. 1 hour.

300. **Special Problems.** An agricultural problem with engineering implications is selected for study, investigation, and report wherein a satisfactory solution does not require a background of engineering education. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. Prerequisite: Not open to students on probation; senior standing; written consent of instructor and authorized departmental approval is required prior to advance enrollment and registration. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
321. **Advanced Farm Machinery Management.** Considerations of the costs of operation, time of replacement, and optimum system selection of farm field machinery; effects of timeliness, power and traction limitations, machine reliability, and weather uncertainty. Prerequisite: Agricultural Mechanization 221 or equivalent. 4 hours or 1 unit.
331. **Farm Machinery Technology.** The role of forces, motions, and strengths in the operation and performance of common farm machinery mechanisms; study of mechanism illustration, machinery testing, service problems, and other aspects of the equipment distribution industry. Field trip to farm equipment manufacturing and distribution centers; estimated cost, \$15.00. Prerequisite: Physics 101 recommended. 4 hours or 1 unit.
361. **Development and Function of Family Housing.** Same as Home Economics 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials and structure, economic influences, costs, and adaptations; and personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural mechanization students, no prerequisite). 3 hours or $\frac{3}{4}$ unit.
381. **Electromechanical Agricultural Systems.** Application of electric power and mechanical equipment to livestock production, crop conditioning, and materials-handling systems for efficient use of time, power, and labor; principles of planning materials-handling systems; requirements for environmental control in agricultural production; electric controls circuits; and factors affecting drying, cooling, and processing of crops. Prerequisite: Agricultural Mechanization 281 or graduate standing in agriculture. 3 hours or $\frac{3}{4}$ unit.

AGRICULTURE

Program Administrator: Dean K. E. Gardner

Program Office: 104 Mumford Hall, Urbana

100. **Agriculture in Modern Society.** Analysis of agriculture in contemporary society and introduction to problems and challenges related to agriculture; includes a brief orientation to the University and the College of Agriculture. Required of all freshmen in agriculture. 1 hour.
190. **Freshman Honors Seminar: International Problems as Related to Agriculture.** Same as Home Economics 190. Lectures and discussion dealing with the broad national and international problems of agriculture; explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
192. **Honors Seminar: Science, Food, and World Population.** Same as Home Economics 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival; explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.

206. **Cooperative Extension Work.** A study of the history, organization, objectives, programs, and methods of extension work. Prerequisite: Agricultural Communications 114; a course in sociology or consent of instructor. 3 hours.
208. **Cooperative Extension Work: Summer Experience.** Full-time work with extension service programs in selected counties under the direction of either farm or home advisers and assistant state leaders. Approximate training period is June to September. Salary sufficient to cover maintenance and expenses provided. Term report required. It is recommended that this course be preceded by Agriculture 206 or Home Economics 377. Prerequisite: Consent of instructor. 2 hours. Offered in the summer session only.
280. **Agriculture Junior-Senior Seminar.** A study of leadership challenges facing agriculture and selected professions within it; explores background, scope, goals, and methods. Class time one-half college-wide, one-half departmental. Open to students in agricultural economics, agronomy, agricultural communications, horticulture, and other agricultural curricula by permission of instructor. 1 hour.

AGRONOMY

Head of Department: Professor R. W. Howell

Department Office: W-201 Turner Hall, Urbana

101. **Introductory Soils.** The nature and properties of soil including origin, formation, and biological, chemical, and physical aspects. Prerequisite: Chemistry 100 or equivalent. 4 hours.
110. **Plant and Animal Genetics.** Same as Animal Science, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours.
121. **Principles of Field Crop Science.** An introductory course; kinds, origin, taxonomy, morphology, and physiological and ecological bases of growth, reproduction, improvement, and utilization of corn, soybeans, small grains, forage crops, and sorghums; cropping and tillage practices and principles; and field-crop production hazards. 4 hours.
290. **Undergraduate Agronomy Seminar.** The course includes reports and discussions of crops and soils research. Prerequisite: Senior standing. 1 hour.
299. **Undergraduate Thesis.** Individual research problems in agronomy under the direction of a faculty member in agronomy. Normally the student enrolls during the summer between his junior and senior years and during the fall semester of his senior year, or during both semesters of his senior year. Recommended for those who plan to do research and/or graduate study. Thesis problems should be discussed with the supervising faculty member in the semester preceding enrollment and must be approved by the Agronomy Undergraduate Thesis Committee before enrollment. A maximum of 5 hours may be counted toward graduation. An approved thesis must be presented for credit to be given. Prerequisite: Junior standing; minimum grade-point average of 4.0; consent of instructor. 2 to 5 hours.
300. **Advanced Special Problems.** Individual problems in crops or soils. Graduate students majoring in agronomy do not receive graduate credit. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; consent of instructor. Approval of the agronomy teaching coordinator is required prior to advance enrollment and registration. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or ½ to 2 units.
301. **Soil Survey with Emphasis on Illinois Soils.** Properties and methods used in distinguishing soils; characteristics and distribution of different soils in Illinois; and the cause

of these differences and their influence upon proper soil use and management. Laboratory work includes instruction in mapping soils and the use of soil maps, and field trips to examine representative soils. Estimated cost of field trips, \$10.00. Prerequisite: Agronomy 101 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

303. **Soil Fertility and Fertilizers.** Factors affecting the supply of available major, secondary, and minor elements in soils and their influence on crop production; evaluating fertilizer and lime needs; and fertilizer manufacture, sources, and application methods. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit.
304. **Soil Management and Conservation.** Application of principles of soil management to the solution of land-use and conservation problems; influence of soil characteristics on drainage, erosion control, cropping intensity, water management, and land-use planning. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit.
305. **Biochemical Processes in Soil and Water Environments.** Metabolic processes leading to chemical transformations in soil and water environments; implications for soil fertility and environmental pollution. Prerequisite: Microbiology 100; Chemistry 102. 3 hours or $\frac{3}{4}$ unit.
306. **The Dynamics of Soil Development.** The relationship of soils as complex dynamic bodies to various disciplines important to their understanding, such as geology, geomorphology, chemistry, and ecology; discussion of the importance of having an overall model to help in understanding soils; and two field trips to be arranged. Prerequisite: Agronomy 101, Chemistry 102, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Soil Chemistry.** Emphasis on the inorganic reactions involved in soil development and plant nutrition in soils; topics discussed include colloid systems, properties of water, ion exchange equilibria, plant nutrient forms, and methods of analyses. Prerequisite: Agronomy 101; Chemistry 102. 3 hours or $\frac{3}{4}$ unit.
308. **The Physics of the Plant Environment.** The physics of transport processes in the soil and aerial environment of plants; exchanges of energy and gases in crop canopies and the retention of flow of water, gases, solutes, and heat in soils. Prerequisite: Physics 102; one semester of calculus. 4 hours or 1 unit.
312. **Farm Appraisals.** Same as Agricultural Economics 312. Valuation methods and value bases of farm real estate; legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agronomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, \$10.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, $\frac{3}{4}$ or 1 unit).
313. **Soil Mineral Analysis.** Specialized analytical procedures for determinations of soil minerals and their properties; mineralogy of soils and relationships to soil genesis and fertility. Prerequisite: Agronomy 101 or consent of instructor. 4 hours or 1 unit. Offered in 1975-76 and in alternate years.
319. **Environment and Plant Ecosystems.** Same as Forestry 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes; physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels are discussed in basic language. Prerequisite: One course in biology; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
320. **Crop Physiology.** The physiological basis of crop plants; how the physiological processes influence potential crop yield and crop production. Prerequisite: Botany 100 or equivalent; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Forage Crops and Pastures.** Forages, their plant characteristics, ecology, and production; grasslands of farm and range as related to animal production and soil conservation. Prerequisite: Agronomy 121. 3 hours or $\frac{3}{4}$ unit.
323. **Principles of Plant Breeding.** Same as Horticulture 323. Genetic and cytological variation in crop plants; the production and control of such variation in developing varieties

- and hybrids; and the maintenance of high quality seed stocks. Field trips; estimated cost, \$5.00. Prerequisite: Botany 100; Agronomy 110 or equivalent. 4 hours or 1 unit.
326. **Weeds and Their Control.** Weeds, their introduction, methods of dissemination, reproduction, and control; a characterization of the common weeds of the Midwest. Prerequisite: Agronomy 121. 3 hours or $\frac{3}{4}$ unit.
 333. **Physiology Laboratory.** Same as Botany 333 and Horticulture 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.
 340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
 350. **Crops and Man.** Interpretations of the role of crop plants in the development of cultures and civilizations; description of crops primarily in terms of their origins, evolution, and influences on man's technology, art, religion, and social and political institutions. Field trip; estimated cost, \$10.00. 3 hours or $\frac{3}{4}$ unit.
 365. **Digital Computer Methods for Statistical Data Processing.** Same as Computer Science 365. A study of methods for efficient utilization of high-speed equipment in the processing of statistical data; emphasis on principles of application of computing equipment to the solution of statistical problems. Students are expected to solve problems on the computers. Prerequisite: A course in statistics or statistical methods, or equivalent; any computer science 100-level programming course or consent of instructor. 3 hours or 1 unit.
 377. **Diseases of Field Crops.** Same as Plant Pathology 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
 400. **Seminar.** Discussions of current literature in crops and soils. Required of all graduate majors in agronomy. Prerequisite: Graduate standing. 0 credit.
 402. **The Chemistry of Soil Fertility.** The chemistry of the essential plant nutrients in soils, their reactions, and their quantitative relationship to plant growth. Lectures, discussions, and assigned readings. Prerequisite: Agronomy 101; Chemistry 122. 1 unit. Offered in 1974-75 and in alternate years.
 403. **Genesis, Morphology, and Classification of Soils.** Historical review of soil genesis and classification; morphology and genesis of diagnostic soil horizons and features; soil genesis processes and reactions; classification of soils; and characteristics, geography, and production potentials of major soil groups of the world. Lectures, discussions, and assigned readings. Prerequisite: Agronomy 301 or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
 405. **Colloidal Chemistry of Soils.** Soil components, their nature, and their influence on the physical, chemical, biological, and electrokinetic properties of soils. Lectures, discussions, and assigned readings. Prerequisite: Chemistry 340 and 341, or equivalent. 1 unit.
 411. **Soil Physics.** The derivation and application of the fundamental physical principles and laws which govern the behavior of soils; emphasis on transport phenomena and physical characteristics of soils. Lectures, discussions, and assigned readings. Prerequisite: One year of calculus. 1 unit. Offered in 1974-75 and in alternate years.
 412. **Soil Organic Matter.** Basic considerations in organic matter transformation; geochemistry of organic matter; nature and origin of humic substances; and reactions of organic matter in soils and sediments. Lectures, discussions, and assigned readings. Prerequisite:

site: Agronomy 309 or consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.

- 414. Physical Chemistry of Clays and Soils.** Same as Mining Engineering 414 and Ceramic Engineering 414. The application of physical-chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
- 422. Pasture, Range, and Soil Conservation Research.** Discussion and study of data and literature pertaining to pastures, range, and soil conservation; application of research methods to the evaluation of forage species in the management and utilization of pasture and range and to soil conservation. Prerequisite: Agronomy 121, or 322. 1 unit.
- 423. Cytogenetic and Evolutionary Basis of Plant Breeding.** Nature and origin of crop species; genetic and cytogenetic basis for developing special plant materials and the use of such materials in breeding programs; and emphasis on discontinuous variation. Prerequisite: Agronomy 323 or equivalent, or consent of instructor. 1 unit.
- 424. Mineral Nutrition of Plants.** Same as Botany 424 and Horticulture 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in the light of metabolic activity and constituency in functional plant compounds; major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
- 429. The Evolution of Agricultural Economies.** Same as Anthropology 429 and Geography 429. The problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
- 436. Advanced Plant Physiology: Photosynthesis.** Same as Botany 436. Lecture and laboratory dealing with physiological, biochemical, and biophysical aspects of photosynthesis. Prerequisite: One year each of college biology, chemistry, and physics, or consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.
- 440. Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Agronomy 340 or equivalent. $\frac{3}{4}$ unit.
- 441. Advanced Design and Analysis of Biological Experiments.** Same as Agricultural Engineering 441. Design and analysis of complex experiments; confounded factorials, lattice designs, and other incomplete-block experiments are considered from the viewpoint of their characteristics, methods of analysis, and usefulness in biological research. Prerequisite: Agronomy 440 or equivalent. $\frac{1}{2}$ unit. Offered in 1974-75 and in alternate years.
- 442. Environmental Plant Physiology.** Same as Botany 442. Lecture course dealing with the interaction of plants and environment at the level of the whole organism, extending to the cell and the community; emphasis on heat and mass transfer, plant and soil potentials, and the effects of light on growth. Prerequisite: Chemistry 131; general physics; general or plant physiology; consent of instructor. $\frac{3}{4}$ unit.
- 444. Quantitative Aspects of Plant Breeding.** A study of the theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction, and effectiveness of different selection procedures. Prerequisite: Agronomy 323 and 440, or equivalent. 1 unit.
- 462. Origin of Variation in Plants.** Same as Botany 462. Study of the principles of plant evolution; discussion of theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaptation. Prerequisite: Consent of instructor. 1 unit.

493. **Advanced Studies in Agonomy.** Directed and supervised detailed study of selected problems or topics. Prerequisite: Consent of instructor. Study may be in any one of the following fields: (a) soil chemistry; (b) soil fertility; (c) soil physics; (d) soil classification and pedology; (e) soil mineralogy; (f) soil microbiology; (g) plant breeding and genetics; (h) plant physiology; (i) weed control; (j) crop morphology; (k) crop production and ecology; or (l) statistical techniques and data processing. $\frac{1}{4}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.

AIR FORCE AEROSPACE STUDIES

Head of Department: Colonel J. J. DeJonghe

Department Office: Room 232 Armory, Champaign

100. **Leadership Laboratory.** A practical training program designed to teach students basic military drill movements, customs, and courtesies of the service, and principles of group leadership. All students in the Air Force ROTC program are required to participate in this laboratory. The specific training varies in depth with the experience and cadet grade of the individual. One hour of laboratory per week. No credit, but must be taken in conjunction with other courses.
111. **Freshman Theory Course: United States Military Forces in the Contemporary World, I.** An introductory theory course to familiarize the student with the doctrine, mission, and organization of the United States Air Force; the functions of United States strategic offensive and defensive forces are covered. Prerequisite: Consent of Professor of Air Force Aerospace Studies. 1 hour.
112. **Freshman Theory Course: United States Military Forces in the Contemporary World, I.** Continuation of Air Force Aerospace Studies 111. Includes a further study of United States strategic defensive forces with emphasis placed on missile defense; United States general purpose forces and aerospace support forces including a discussion of the United States Army, Navy, Marine Corps, and major support commands of the United States Air Force. Prerequisite: Air Force Aerospace Studies 111 or consent of Professor of Air Force Aerospace Studies. 1 hour.
121. **Sophomore Theory Course: United States Military Forces in the Contemporary World, II.** A study of the organization of the Department of Defense and the role of the military in national policies. In addition, an analysis of the nature and principles of war is presented. Prerequisite: Air Force Aerospace Studies 112 or consent of Professor of Air Force Aerospace Studies. 1 hour.
122. **Sophomore Theory Course: United States Military Forces in the Contemporary World, II.** Continuation of Air Force Aerospace Studies 121. Includes a study of the military policies and strategies of the Soviet Union and China, the role of alliances in United States defense policy, and some of the various elements and processes in the making of defense policy. Prerequisite: Air Force Aerospace Studies 121 or consent of Professor of Air Force Aerospace Studies. 1 hour.
231. **Junior Theory Course: Growth and Development of Aerospace Power, I.** A survey course about the nature of war; development of air power in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; the future development of aerospace power; and problems in space exploration. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful completion of appropriate mental aptitude and physical test. 3 hours.
232. **Junior Theory Course: Growth and Development of Aerospace Power, II.** A survey course about the nature of war; development of air power in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and em-

ployment; astronautics and space operations; the future development of aerospace power; and problems in space exploration. Prerequisite: Completion of all freshman and sophomore theory courses or consent of professor of air force aerospace studies; successful completion of appropriate mental aptitude and physical test; satisfactory completion of Air Force Aerospace Studies 231 or consent of Professor of Air Force Aerospace Studies. 3 hours.

241. **Senior Theory Course: The Professional Officer, I.** A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the military justice system; leadership theory, functions, and practices; management principles and function; problem solving; and management tools, practices, and controls. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful completion of the Air Force Officer Qualification Test and a military physical examination. 3 hours.
242. **Senior Theory Course: The Professional Officer, II.** A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the military justice system; leadership theory, functions, and practices; management principles and function; problem solving; and management tools, practices, and controls. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful completion of the Air Force Officer Qualification Test and a military physical examination. 3 hours.

ANIMAL SCIENCE

Head of Department: Professor D. E. Becker

Department Office: 328 Mumford Hall, Urbana

100. **Introduction to Animal Science.** A survey of the livestock and poultry industries with emphasis on the importance of product technology and the basic principles of nutrition, genetics, physiology, and ecology as they apply to the breeding, selection, feeding, and management of beef cattle, horses, poultry, sheep, and swine. 3 hours.
109. **Meat Purchasing and Preparation.** A general approach to the subject of meat utilization with emphasis devoted to the physical and chemical composition, nutritive value, selection, and utilization of meat cuts. When appropriate, field trips are taken to area commercial establishments; estimated cost, \$10.00. 2 hours. Offered in 1975-76 and in alternate years.
110. **Plant and Animal Genetics.** Same as Agronomy, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 5 hours.
200. **Special Problems.** Individual research in animal science. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
201. **Livestock Management.** Same as Dairy Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Animal science and dairy science majors do not receive credit for this course. Prerequisite: Animal Science 221 or 325. 5 hours.
206. **Light Horse Management.** The horse industry; anatomy, selection, breed types, gaits,

- nutrition and feeding, breeding and reproduction, health and disease, tack and equipment, training and showing, and housing of pleasure horses. 3 hours.
207. **Companion Animal Management.** Biological management of companion animals emphasizing the dog and cat as well as others such as the rabbit, the bird, and fish; subject matter includes anatomy, breeds and breed types, selection, nutrition, reproduction, genetics, training, health and disease, equipment needs, and showing of small animals. 3 hours.
209. **Meat Animal Evaluation.** Principles and techniques of meat animal and carcass evaluation and their relationship to current practices in industry. Demonstrations and student participation. Prerequisite: Animal Science 100. Students may register for 3 hours credit without the laboratory or for 4 hours credit with the laboratory in animal slaughter and carcass fabrication. 3 or 4 hours.
210. **Meat Selection and Classification.** Characteristics associated with the value of carcasses and wholesale cuts from meat animals; grading and classification. Field trips to meat packing plants are required; estimated cost, \$20.00. Prerequisite: Animal Science 209. 2 hours.
211. **Breeding Animal Evaluation.** The application of current scientific tools, methods, and performance programs available to livestock breeders for improving beef cattle, swine, sheep, and horses; emphasis on the changing nature of modern breeds of livestock as influenced by selection, economics, and consumer and market trends. Prerequisite: Sophomore standing and credit or concurrent registration in Animal Science 209.
212. **Advanced Livestock Evaluation.** Advanced instruction in evaluating meat animals for slaughter and selection of breeding animals. Laboratory. Prerequisite: Animal Science 209 and 211. 3 hours.
221. **Animal Nutrition.** Same as Dairy Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Animal Science 221 and 325. Prerequisite: Chemistry 102 or equivalent. 4 hours.
230. **Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Dairy Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104 and one course in chemistry. 3 hours.
299. **Seminar.** Individual oral presentations and written reports by senior students in animal science on subjects related to research in the animal sciences. 1 hour.
301. **Beef Production.** The principles of feeding and management of beef cattle; financial aspects of beef production; and diseases, parasites, and breeding difficulties of beef cattle. Lectures, demonstrations, and discussions. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ or $\frac{3}{4}$ unit).
302. **Sheep Production.** The sheep and wool industries; principles and practices of various phases of production. Students may register for 3 hours credit without laboratory, for 4 hours credit with laboratory, or for $\frac{3}{4}$ unit. Prerequisite: Animal Science 221 or equivalent. 3 or 4 hours, or $\frac{3}{4}$ unit.
303. **Pork Production.** The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit.
304. **Poultry Management.** The application of science and technology in solving the breeding, feeding, housing, and various management problems encountered in commercial egg and poultry meat production. Three hours credit without or 4 hours credit with individual study and conference, or $\frac{3}{4}$ unit. Prerequisite: Animal Science 221 or 325, or equivalent. 3 or 4 hours, or $\frac{3}{4}$ unit.
305. **Genetics and Animal Improvement.** Same as Dairy Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Animal Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit).
307. **Environmental Aspects of Animal Management.** Animal-environmental interactions (including thermal, air, microbic, photic, sound, and behavioral factors) as bases for prescribing practical environments for production of animals. Prerequisite: Courses in

physiology, nutrition, microbiology, and genetics respectively are recommended. 3 hours or $\frac{3}{4}$ unit.

309. **Meat Science.** Fundamental biological principles that influence growth, composition, processing, preservation, and quality of meat and meat products. Prerequisite: Chemistry 102; Microbiology 100 and 101, or 200 and 201. Field trip required; estimated cost, \$15.00. 4 hours or 1 unit.
320. **Nutrition and Digestive Physiology of Ruminants.** Same as Dairy Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Animal Science 221. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
325. **Principles of Animal Nutrition.** Principles of animal nutrition and their application to veterinary practice. This course is designed primarily for students in veterinary medicine. Credit is not given for both Animal Science 325 and 221. Prerequisite: Biochemistry 354, or Biochemistry 350 and 355. 5 hours or 1 $\frac{1}{4}$ units.
330. **Reproduction and Artificial Insemination of Farm Animals.** Same as Dairy Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science 100 or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
332. **Livestock Marketing.** Same as Agricultural Economics 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; and evaluation of changes in the industry affecting marketing decisions. Field trip; estimated cost, \$15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
341. **Human Evolution, II.** Same as Anthropology 341. The principles of human genetics; anthropological aspects of race and race formation; and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 102 or Zoology 101 or 104, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work is required of graduate students registering for 1 unit.
346. **Ethology.** Same as Anthropology 346 and Zoology 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or $\frac{3}{4}$ unit.
347. **Ethology Laboratory.** Same as Anthropology 347 and Zoology 347. Laboratory in ethology. Prerequisite: Animal Science 346; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
350. **World Animal Agriculture.** Same as Dairy Science 350. Survey and interpretations of the role of animal agriculture in various cultures of the world with particular references to underdeveloped countries of the world; discussion of the importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Animal Science Graduate Seminar.** Discussion of current literature in animal science. Required of all graduate majors in animal science. May be repeated for credit not to exceed 1 unit. Sections offered in animal nutrition, environmental management, meat science and muscle biology, and reproductive physiology. 0 or $\frac{1}{4}$ unit.
401. **Animal Bionomics.** A lecture and discussion course pertaining to the ecological factors affecting physiological, functional, behavioral, and productive response of domestic animals. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.

- 402. Principles of Sheep and Wool Production.** Basic considerations in sheep and wool production and lamb feeding; reports of research. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
- 403. Techniques and Topics in Animal Research.** Discussion and study of literature pertaining to animal research; application of experimental techniques; special topics; and review of research in current problem areas. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
- 404. Concepts in Nonruminant Nutrition.** A review of current literature in nonruminant nutrition. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
- 406. Physiology of Reproduction.** Same as Zoology 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit.
- 408. Laboratory Methods in Physiology of Reproduction.** Same as Zoology 408. Combined credit in Animal Science 407 and 408 may not exceed 2 units. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 units.
- 409. Muscle Biology.** Microstructure and chemical composition of muscle tissue; chemistry and biosynthesis of muscle and connective tissue proteins; and biochemical aspects of muscle contraction and rigor mortis. Prerequisite: Biochemistry 350 and 355. $\frac{1}{2}$ unit.
- 410. Research Methods in Animal Science.** Intended to give students training and experience in various techniques used in research with poultry, sheep, swine, beef cattle, and meats. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated for credit not to exceed a total of 1 unit.
- 412. Advanced Endocrinology.** Same as Dairy Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312 or Zoology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated for credit not to exceed a total of 2 units.
- 420. Comparative Nutrition.** Physiological aspects of the nutrition of higher animals and man, including the digestion, utilization, and function of nutrients, and the effects of dietary deficiencies. Prerequisite: Biochemistry 350 and 355. 1 unit.
- 421. Topics in Nutritional Biochemistry.** Biochemical aspects of the nutrition of higher animals and man, with emphasis on the function and metabolism of nutrients. Prerequisite: Animal Science 420. 1 unit.
- 440. Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Animal Science 340 or equivalent. $\frac{3}{4}$ unit.
- 463. Radioisotopes in Biological Research: Principles and Practice.** Same as Biophysics 463 and Veterinary Medical Science 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, biology, and/or consent of instructor. 1 unit.
- 481. Animal Biochemical Laboratory Techniques.** Same as Dairy Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences; isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; and determination of metabolic pathways and processes. Prerequisite: Biochemistry 350 and 355; consent of instructor. 1 unit.
- 499. Thesis Research.** 0 to 4 units.

ANTHROPOLOGY

Head of Department: Professor C. E. Cunningham

Department Office: 109 Davenport Hall, Urbana

101. **Concepts in General Anthropology.** Offered as a concentrated alternative to the Anthropology 102 and 103 sequence, this course introduces fundamental concepts in human biology, prehistory, culture and society, and linguistics; taught by a faculty team representing the subfields of general anthropology who present their subjects by examining important issues and problems in the discipline. An understanding of these crucial ideas and their interrelationships prepares serious students to go directly into more advanced courses. Credit is not given for Anthropology 101, and Anthropology 102 and 103. 4 hours.
102. **Introduction to Anthropology: The Origin of Man and Culture.** An introduction to and survey of human origins and early man, physical anthropology, race and racism, archaeology, and the beginning of human civilization. Recommended though not required to be taken with Anthropology 103 as a survey of the field of anthropology. Credit is not given for Anthropology 102 and 103, and Anthropology 101. 4 hours.
103. **Introduction to Cultural Anthropology.** Survey of cultural anthropology; deals with the nature of culture and its various aspects including social organization, technology, economics, religion, and language, as these are seen among contemporary primitive or preliterate peoples; and some attention also given to distinctive theoretical approaches and to problems of culture change. Credit is not given for Anthropology 103 and 102, and Anthropology 101. 4 hours.
143. **Biological Bases of Human Behavior.** Same as Home Economics, Psychology, and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
168. **Indian Civilization and Society.** Same as History 168. An introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as History 169. An interdisciplinary introduction to modern South Asian history and society. 4 hours.
173. **Cultural Diversity.** Cultural diversity poses personal problems as well as social issues; surveys various cultures as collective patterns for living and as attempts to create a more human way of life; and examines methods for depicting and interpreting cultural codes of behavior, thought, and feeling, with stress on the uses of ethnography in a world of plural cultures. 3 hours.
174. **American Communities and Their Problems.** An examination of American society and its cultural heterogeneity through the study of selected communities, community problems, and solution alternatives. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elements of Linguistics.** Same as Linguistics 200. An elementary survey of the methods used in descriptive and historical linguistic analysis, with application to languages usually taught in college. Prerequisite: One year of a foreign language or equivalent. 3 hours.
210. **Family Relationships.** Same as Home Economics 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; and examination of selected family adjustment problems. 3 hours.
220. **Introduction to Prehistory.** An introduction to the problems of studying past cultures; special attention given to the ranges of techniques available and the adequacy of various methodologies as bases for sound inference about the structure of extinct cultures. Prerequisite: Anthropology 101 or 102, or consent of instructor. 3 hours.

222. **Introduction to Modern Africa.** Same as African Studies, Political Science, and Sociology 222. An interdisciplinary introduction to modern Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
230. **Introduction to Social Anthropology and Ethnology.** An introduction to the anthropological study of contemporary human societies; emphasis on the comparative study of social organization, interpersonal relations, cultural ecology, and processes of sociocultural change, but also includes some consideration of the method and theory of ethnological field research. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours.
240. **Introduction to Biological Anthropology.** The past and present evolution of man and his populational and individual biological variation; topics include genetic principles relevant to human evolution, primate phylogeny and behavior, fossil evidence for human evolution, and the origin and significance of biological diversity in modern man. Prerequisite: Anthropology 101, 102, or 143; or an introductory life sciences course; or consent of instructor. 3 hours.
246. **Vertebrate Social Organization.** Same as Psychology, Sociology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
247. **An Introduction to Behavior Genetics: Lecture.** Same as Psychology 247. Examination of relations between genetic mechanisms, population structure, race, and individual differences in behavior; survey of research and future possible behavior-genetic analyses; and applications like genetic counseling. Prerequisite: Psychology 100, 103, or 105, or Biology 100, Physiology 103, or Zoology 104; a course in statistics which may be taken concurrently. 3 hours.
250. **Introduction to Primitive Technology.** Introduction to the technology of nonindustrial societies; relationships of technology to society; and influence of social and cultural factors on technological innovation. Ethnographic, historical, and archaeological data are used. 3 hours.
260. **Peoples of the World: Introduction to Ethnography.** The study and criticism of ethnographic descriptions of exotic ways of life, both as scientific reporting and as a literary art form. Readings include examples from several major culture areas: Africa, the Americas, the Middle East, Oceania, southern and eastern Asia, and Western civilization. Prerequisite: Anthropology 101, 102, or 103, or consent of instructor. 3 hours.
261. **Afro-American Societies and Cultures.** Designed to examine the breadth of the black Americas in South America, Central America, the Caribbean (including Spanish, Gallic, Dutch, and English subareas), and Canada, with specific comparisons to rural and urban United States; the African slave trade with reference to black-white relations in the trade; the development of Creole cultures in West Africa and in Spain and subsequent cultural elaboration in the New World; conditions of slavery, slave revolts, migrations of black people in the New World; and examination of selected ethnographic material. Prerequisite: Anthropology 101, 102, or 103, or consent of instructor. 4 hours.
262. **Afro-American Styles and Strategies.** Comparative study of Afro-American life-styles and social strategies in the United States and the West Indies; centrally concerned with the contemporary unfolding of Afro-American continuities in the two areas with special attention to the following topics: economic oppression, movements of black self-liberation, and Afro-American creativity and symbolism. Prerequisite: Anthropology 261 or Political Science 245, or consent of instructor. 4 hours.
280. **Anthropological Theory in Contemporary Perspective.** Designed primarily to explore the current state of theory and conceptualization in cultural and social anthropology; emphasis on the relationship between current theoretical and conceptual formulations and the historical development of anthropological thought. Prerequisite: A major in anthropology or consent of instructor. 3 hours.

- 289. Independent Study Course.** Supervised reading and research on anthropological topics chosen by the student with staff approval. Especially (but not exclusively) for students who are preparing for a summer field-work project, or who have some justifiable reason for doing independent study, but who do not qualify for the honors (departmental distinction) courses. May not be taken concurrently with Anthropology 290 or 291. Prerequisite: Junior or senior standing; 12 hours in anthropology; consent of instructor. 2 to 4 hours.
- 290. Honors Course.** Individual study and research projects for those students who are candidates for departmental distinction in anthropology. May not be taken concurrently with Anthropology 289. Prerequisite: Senior standing; 4.2 grade-point average in anthropology; consent of instructor. 2 to 4 hours.
- 291. Honors Thesis.** Preparation and completion of a senior honors thesis, research paper, or equivalent project for those students who are candidates for high or highest departmental distinction in anthropology. May not be taken concurrently with Anthropology 289. Prerequisite: Senior standing; 4.2 grade-point average in anthropology; consent of instructor. 2 to 4 hours.
- 300. Introduction to Linguistics.** Same as Linguistics 300. An introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 307. Introduction to Mathematical Linguistics.** Same as Linguistics 307. Principles of set theory, logic and formal systems, group theory, and automata theory; introduction to the formal theory of grammars. Prerequisite: Anthropology 300. 3 hours or 1 unit.
- 315. Area Studies in Ethnomusicology.** Same as Music 317. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, or American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 12 hours or 2 units.
- 316. Introduction to Music of the World's Cultures.** Same as Music 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to the methods of collecting and studying music in nonliterate cultures, folk cultures, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 317. Languages of the World.** Same as Linguistics 317. A survey of the main language families of the world from both genetic and typological points of view, with special references to the theory of syntactic descriptions. Prerequisite: Anthropology 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 320. Political Anthropology.** The analysis of political behavior and the comparison of political systems from an anthropological perspective; emphasis on local level political processes and the evolution of governmental forms. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
- 321. Social Organization and Structure.** An introduction to anthropological concepts of social organization and structure; considers kinship theory, descent and alliance systems, social stratification, nonkin association, social networks, group identification and boundaries, structural-functional interpretations of society, and the meaning of social or cultural structure. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
- 322. Anthropology of Law.** Analyzes the legal systems of several primitive societies, the social context in which such legal systems operate, and the place of such studies in developing a theory of jurisprudence; special attention given to legal changes in the developing nations and to the legal problems of minority populations. Prerequisite: Anthropology 103, 260, or 280, or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 329. The Philosophy of Social Science.** Same as Philosophy 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.

330. **Processes of Culture Change.** The impact of modern cultures on native peoples, comparative study of the mechanisms underlying the transition to modernity in the new nations, and the psychological and structural aspects of acculturation and urbanization. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or ½ or 1 unit.
331. **Aboriginal North America.** Deals with three major topics: the nature and structure of aboriginal North America as a cultural province and its ecological base; distinctive and common features of American Indian cultures; and responses to the stresses of white contact. Selected type cultures and their adaptations to varying ecological situations are examined in detail. Credit is not given for both Anthropology 331 and 270. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or ½ or 1 unit.
332. **Indians of Lowland South America.** A survey of aboriginal non-Andean peoples in contemporary settings; historical and geographical bases for cultural adaptation and elaboration; and ethnicity, cultural ecology, social organization, ritual, and change in selected areas of Lowland South America. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
333. **South American Indians of the Andean Region.** A survey of Andean cultures at the time of the Spanish conquest, of their subsequent history, and of modern Indian culture in the Andean countries. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
334. **The Structural Study of South American Indian Cultures.** A comparative discussion of cultural systems, including their social, religious, and economic aspects; in general, the better-known peoples of South America are considered. Prerequisite: Anthropology 332 or 333, or consent of instructor. 3 hours or 1 unit.
337. **Behavior Genetics Laboratory.** Same as Psychology 347. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Consent of instructor or academic counselor of the Department of Psychology; concurrent registration in Anthropology 336. 2 hours or ½ unit.
340. **Human Evolution, I.** Principles of evolution and a survey of the evolution of man and his progenitors from the early primates through the Pleistocene epoch; emphasis on evolutionary theory as applied to man and interpretation of the fossil record. Prerequisite: Anthropology 240 or an introductory zoology course, or consent of instructor. 3 hours or 1 unit.
341. **Human Evolution, II.** Same as Animal Science 341. The principles of human genetics; anthropological aspects of race and race formation; and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 240 or an introductory zoology course, or consent of instructor. 3 hours, or ½ or 1 unit. Additional work is required of graduate students registering for 1 unit.
342. **Behavior-Genetic Analysis.** Same as Psychology 342 and Zoology 350. Concepts, methods, and problems in the analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240 or Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or ¾ or 1 unit.
343. **Introduction to Primate Morphology and Behavior.** Same as Zoology 344. Survey of primate social behavior and the classification, morphology, and distribution of living and extinct species; emphasis placed on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240 or Zoology 246, or consent of instructor. 3 hours, or ½ or 1 unit.
344. **Field and Laboratory Techniques in Biological Anthropology.** Supervised participation in biological anthropology research projects; techniques, methods, and procedures discussed and practiced under actual field or laboratory working conditions. Normally taken concurrently with Anthropology 345. Prerequisite: Anthropology 240 or equivalent; consent of instructor. 3 hours or 1 unit. Students may receive credit more than once if the area or problems involved are different. Usually offered in the summer session only.

345. **Analysis of Research Data in Biological Anthropology.** Analysis, interpretation, evaluation, and organization of field and laboratory data in biological anthropology; preparation of written reports on research. May be taken concurrently with Anthropology 344 or subsequently. Prerequisite: Anthropology 240 or equivalent; consent of instructor. 3 hours or 1 unit. Students may receive credit more than once if the area or problems involved are different. Usually offered in the summer session only.
346. **Ethology.** Same as Animal Science 346 and Zoology 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or $\frac{3}{4}$ unit.
347. **Ethology Laboratory.** Same as Animal Science 347 and Zoology 347. Laboratory in ethology. Prerequisite: Anthropology 346; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
348. **The Prehistory of Africa.** The study of cultural development in Africa from the appearance of hominids to the time of European domination. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
349. **South American Culture History, I.** An examination of the factors influencing the initial peopling of South America; the spread and diversification of hunting and gathering economies; and the development and spread of the tropical forest cultural pattern. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
350. **South American Culture History, II.** An examination of the factors leading to the rise of civilization in the central Andes, including the evolution of agricultural systems, the elaboration of technology, and the emergence of extensive and complex political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
351. **Archaeological Surveying: Techniques and Applications.** Familiarization with methods used in the location and recording of archaeological sites, including techniques of mapping especially adapted to the needs of archaeology; attention given to means of presenting results and interpreting data derived from this work; and work both in the field and in the laboratory. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
352. **Mesoamerican Culture History.** A detailed study of the major civilizations of Mexico and Guatemala, with brief reference to other Mesoamerican cultural traditions; emphasis on the growth and ramifications of civilizations and the kinds of evidence used to study the growth and interaction of political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
353. **Southwestern Archaeology.** A detailed study of one archaeological unit in the United States, covering the three broad cultures with regional variations considered chronologically and stressing interrelationships of the various cultures. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Field Techniques in Archaeology.** Participation in archaeological excavations; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 355. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 101 or 102, or consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
355. **Laboratory Techniques in Archaeology.** Laboratory work including processing, classifying, dating, interpretation, evaluation, and preparation of written reports of archaeological research. May be taken concurrently with Anthropology 354 or subsequently. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 101 or 102, or consent of instructor. 3 hours or 1 unit.
356. **Physical Anthropology.** The aims and methods of physical anthropology, both osteology and somatology, with emphasis on the human skeleton. Prerequisite: Anthropology 240, or a physiology or zoology course in anatomy, or consent of instructor. 3 hours or 1 unit.
357. **Midwestern Prehistory.** A detailed study of the midwestern archaeological area covering the broad cultures with regional variations considered chronologically and stressing

- their interrelationships. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **Prehistory of the Old World: Paleolithic and Mesolithic.** Considers the origins of human culture and surveys the development of and relationships among cultural traditions in Africa, Asia, and Europe during the Pleistocene epoch. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
359. **Prehistory of the Old World: Neolithic, Bronze, and Iron Ages.** Continuation of Anthropology 358 into post-Pleistocene times; an introduction to postglacial hunting communities, the origins of food production and animal husbandry, early metallurgy and urbanism, and the rise of major civilizations; emphasis on Europe, the Near East, and the Mediterranean basin, with comparisons to Africa and Asia. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
360. **Peoples of Oceania.** A survey of the peoples inhabiting the islands of the Pacific, and their culture history, including Australia, Melanesia, Micronesia, New Zealand, and Polynesia. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
361. **Peoples and Cultures of Mexico and Guatemala.** A survey of the peoples and cultures of middle America with special emphasis upon Mexico and Guatemala; begins by placing middle America geographically, historically, and culturally within the broader Latin American scene; countries first viewed as a whole and then selected ethnographic studies of specific communities considered for comparative purposes. The Caribbean is not included in this survey. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
362. **Asian Prehistory.** An examination of archaeological data, primarily up to the metal ages, for the major areas of Asia; detailed consideration of developmental, diffusionist, and systems models for explaining these data. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
363. **Religion in Anthropological Perspective.** Same as Religious Studies 363. An introduction to the study of magical and religious beliefs and practices in tribal and peasant societies; considers theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socioreligious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
364. **Field Work in Cultural Anthropology.** Supervised participation in field research in ethnography, ethnology, linguistics, or social anthropology; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 365. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
365. **Analysis of Field Data in Cultural Anthropology.** Analysis, interpretation, evaluation, and organization of field data in cultural anthropology; preparation of written reports on research in ethnography, ethnology, linguistics, or social anthropology. May be taken concurrently with Anthropology 364 or subsequently. Students may receive credit more than once if the area or problems involved are different. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit.
367. **Cultures of Africa.** Culture and social organization in traditional African societies with emphasis on the politics, kinship, and religion of a small sample of societies illustrating the main cultural variations found in sub-Saharan Africa; some discussion of ecological factors and ethnic group relations in precolonial times. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
368. **Peoples and Cultures of India.** A description and analysis of the social, economic, and religious life of the tribal and peasant peoples of contemporary India considered against the background of Indian geography, population, language distribution, the

caste system, and highlights of Indian cultural development. Prerequisite: Anthropology 168 and 230, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

369. **Introduction to Human Ecology.** Same as Geography, Health Education, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environments, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper, the credit may be 3 or 5 hours.
370. **Language, Culture, and Society.** Same as Communications 370 and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, or one course in communications or linguistics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
371. **Culture and Personality.** A cross-cultural comparative analysis and evaluation of current theories of culture and personality formation; concerned with the sociocultural matrix in which personality develops as well as with the application of personality concepts to the study of primitive and modern society. Prerequisite: An introductory course in anthropology, sociology, or psychology, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
372. **The Anthropological Study of Art.** A review of the anthropological approach to art with emphasis on structural analysis and the relationship of the artist to his culture; consideration of problems of stylistic development within the framework of cultural dynamics and a survey of the major art styles outside of the Western tradition and the Orient. Prerequisite: Three hours of anthropology or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
373. **Theory and Method in the Cross-Cultural Study of Individual Behavior.** Same as Psychology 373. Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception; emphasis on methodological limitations and contributions of cross-cultural study; and discussion of current problems and research. Prerequisite: Six hours of psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Geography, Health Education, Physiology, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Anthropology 369. 4 hours or 1 unit.
377. **Social Change in Africa.** Considers problems of social change in Africa from the beginning of the colonial period; topics considered include colonialism in Africa, nationalism, urbanization and labor migration, changing patterns of leadership, and changes in family structure. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
378. **Sociocultural Factors in African Economic Development.** Same as Rural Sociology 378. An examination of the African development environment and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
379. **Medical Anthropology: The Culture of Health and Illness.** An introduction to concepts and social aspects of health, illness, and curing in different cultures with consideration also of the interaction between folk and modern medicine in developing nations

and the delivery of health care as an international social problem. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.

380. **Applied Anthropology.** Surveys the role of anthropology in practical affairs and the contributions anthropologists can make in such fields as community development, education, foreign affairs, government, public health, and planning for social or technological change. Prerequisite: Anthropology 230, 260, or 280, or consent of instructor. 3 hours or 1 unit.
381. **Russian Culture History and Ethnology.** Same as Geography 381. An historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Siberian Culture History and Ethnology.** Same as Geography 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Japanese Culture.** Human lifeways in Japanese settings; emphasis on problems of adapting traditional institutions and behavior patterns to the needs of modern industrial civilization. Prerequisite: Anthropology 230 or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
384. **Traditional Chinese Social Organization.** A descriptive analysis of premodern Chinese culture and society with emphasis on domestic organization, rural and urban social structure, local government, and folk religion; field studies in modern Taiwan and Hong Kong, of the overseas Chinese, and on the mainland used to exemplify particular aspects of Chinese life. Prerequisite: Anthropology 230 or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
385. **Anthropology of Education.** Same as Educational Psychology 385 and History and Philosophy of Education 385. Introduction to the contribution of anthropology to the cross-cultural study of education, including discussion of material from representative cultures ranging from primitive social groups to present-day national states; education of minority ethnic and subordinate cultures receives special attention; and emphasis on both informal and formal education as a cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
386. **Peoples and Cultures of Mainland Southeast Asia.** The culture, cultural history, and social systems of mainland Southeast Asia: Burma, Thailand, Cambodia, Vietnam, Laos, Assam Hills, upland southwestern China, and Malaya; emphasis on the interaction of complementary ethnic types in the context of local ecology and the Hindu-Buddhist systems of religion and politics of the lowland states. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
387. **Peoples and Cultures of Insular Southeast Asia.** A survey of the cultures and social systems of Indonesia, Malaysia, and the Philippines in the context of the region's history and geographical, economic, political, and religious situation. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
393. **Laboratory in Primate Social Behavior.** Same as Psychology 393 and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
396. **Advanced Human Osteology.** Comprehensive study of techniques of skeletal identification and restoration, paleopathology and the anthropological interpretation of historic disease patterns, bone growth and development, forensic osteology, demographic reconstruction from osteological data (paleodemography), and dental anthropology. Prerequisite: Anthropology 356 or consent of instructor. 3 hours or 1 unit.
399. **Combined Graduate and Undergraduate Seminar.** A research seminar on specialized topics in anthropology. Prerequisite: Consent of instructor. 4 hours or 1 unit. Students

may register in different sections for a total of 8 hours or 2 units; may be repeated in the same semester.

429. **The Evolution of Agricultural Economies.** Same as Agronomy 429 and Geography 429. The problems concerning the development of the several basic food crop economies studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
440. **Problems in Physical Anthropology.** A seminar designed to involve students in the theoretical and methodological approaches to problem areas in physical anthropology. May be repeated for additional credit. Prerequisite: Anthropology 340, 341, or 343; consent of instructor. 1 unit.
443. **Problems in Primate Behavior and Ecology.** Same as Zoology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects; topics vary each semester. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. May be repeated for additional credit.
450. **Seminar in Anthropology.** Analysis of selected topics of special interest in anthropology. 1 unit. May be repeated to a maximum of 2 units.
451. **Social Structure.** Intended to deepen training of advanced students in the descriptive techniques and methods of structural and functional analysis currently employed by social anthropologists. Prerequisite: Consent of instructor. 1 unit.
452. **Research Problems in Archaeology.** Seminar oriented to current research problems in archaeology, designed to acquaint students with theoretical and methodological aspects of particular problems and to develop a critical perspective of archaeological research. May be repeated for additional credit. Prerequisite: Consent of instructor. 1 unit.
453. **The Formal Analysis of Kinship Systems.** A survey of a variety of the world's systems of kinship, marriage, and family organization; concentration on the distinctive properties of kinship systems as a species of social structure, on the formal apparatus for describing and understanding them and their functions, and on the theory of kinship that arises from the use of such formal apparatus. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
460. **Theories and Methods in Anthropology.** A seminar identifying, investigating, and evaluating the various theories and trends as well as methods employed by anthropologists. 1 unit.
463. **Seminar on Field Methods and Research Designs in Cultural Anthropology.** Critical examination of field methods and research designs as reflected in selected studies covering the past seventy years, ranging from early missionary reports to those of contemporary field workers; effort made to discern major trends in methodology; and examination of community studies and comparative studies on both the tribal and peasant levels. Prerequisite: Consent of instructor. 1 unit.
489. **Readings in Anthropology.** Individual guidance in intensive readings in the literature of one or more subdivisions of the field of anthropology, selected in consultation with the adviser in accordance with the needs and interest of the student. Prerequisite: One semester of graduate work in anthropology; consent of adviser. $\frac{1}{2}$ or 1 unit.
490. **Individual Topics in Anthropology.** Supervised individual investigation or study of a topic not covered by regular courses. The topic selected by the student and the proposed plan of study are approved by the adviser and the staff member who supervises the work. Prerequisite: Consent of instructor. 1 to 4 units.
499. **Thesis Research.** Preparation of theses. 0 to 4 units.

ARABIC

(See Linguistics)

ARCHITECTURE

Head of Department: Professor G. D. Ding

Department Office: 106 Architecture Building, Urbana

100. **Architecture Lectures.** A series of lectures designed to present the relation of architecture to other disciplines and professions, the role of the architect in society, the challenges and opportunities of the profession, and the structure of architectural education programs; supplemental discussions; and required readings. 1 hour.
101. **Introduction to Environmental Design.** An introduction to the range of involvements and responsibilities in the environmental design professions (historically and emergent); provides conceptual framework for relating other disciplines to design; and provides initial experience in problem-solving and communication skills. 3 hours.
171. **Basic Design Studio, I.** An introduction to fundamentals of architectural design: object, perception, and light. Vocabulary: figure-ground composition, balance and movement, proportion and rhythm, mass-space organization, multiple viewing positions, one- and two-point perspective, orthographic projection, and freehand drawing. Prerequisite: Credit or concurrent registration in Architecture 100, or consent of department. 3 hours.
172. **Basic Design Studio, II.** Continuation of Architecture 171. Prerequisite: Architecture 171. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Senior Honors in Architecture.** For candidates for honors in architecture. Independent guided study and research in a selected area of architecture. Prerequisite: Senior standing in architecture, a University grade-point average of 4.0 or, in special cases, approval of the head of the department. 3 hours (summer session, 1 to 3 hours). May be repeated to a total of 6 hours with approval of head of department.
211. **Introduction to Ancient and Medieval Architecture.** Historical analysis of architecture in the Near Orient and Europe prior to the Renaissance in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
212. **Introduction to Renaissance and Modern Architecture.** Historical analysis of Western architecture from the beginning of the Renaissance to the present in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
220. **Introduction to Architectural Theory.** Overview of the purpose and means of architecture in relation to other human endeavors and the goals of society; professional alternatives; introduction to research, cognitive processes in design, information handling, communication, and evaluation. Prerequisite: Consent of instructor. 3 hours.
231. **Architectural Construction, I.** An introduction to the building industry, contract construction, architect's role, contract documents, working drawings and specifications, and building codes and zoning ordinances; criteria for the selection of materials, products, and systems for buildings; and the study of building materials and products. 4 hours.
232. **Architectural Construction, II.** A study of the building process; the design professions, the builder, and the manufacturer; written and graphic communication; analysis of building systems; wood, masonry, metal, concrete, and plastics; and comparative and aesthetic requirements. Prerequisite: Architecture 231. 3 hours.

241. **Environmental Technology, I.** The integration of environmental control systems in architecture; factors affecting comfort, health, and safety; fundamentals of atmospheric conditioning of buildings and the equipment and controls systems for varying functions and sizes of buildings; and water supply, waste, sewage, and storm-water disposal systems for buildings. Prerequisite: Architecture 232 or consent of instructor. 4 hours.
251. **Statics and Dynamics.** Introduction to basic statics and dynamics with emphasis on architectural applications. Prerequisite: Mathematics 130 and 135; Liberal Arts and Sciences 141 and 142. 4 hours.
252. **Strength of Materials and Design Applications.** Introduction to strength of materials with emphasis on architectural applications. Prerequisite: Architecture 251. 4 hours.
271. **Basic Design Studio, III.** An understanding of the nature of architectural design: form, structure, and function. Vocabulary: architectural scale, aerial perspective, modular construction, isometric projection, circulation, and freehand drawing. Prerequisite: Architecture 172. 3 hours.
272. **Basic Design Studio, IV.** Continuation of Architecture 271. Prerequisite: Architecture 271. 3 hours.
288. **Man and Environment.** Emphasis on the need for planning for design for both professional and citizen participation in shaping communities and making them function effectively; context developed in the perspective of the exploding demands on the land of an expanding, affluent, technologically advanced, and highly complex urban society in which value conflicts must be resolved; basis for critical assessment of any community within a framework of high standards for attainable environmental excellence. Elective for all students except professional degree students in architecture, landscape architecture, and urban and regional planning. 3 hours.
300. **Independent Studies in Urban Design.** The individual study of selected topics involving the history, design, and function of significant European cities. Prerequisite: One year of history of architecture or history of art; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
310. **Ancient Classical Architecture.** The development of architecture and urban design in the ancient Greek world and the Roman Empire. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Early Medieval Architecture.** The architecture and urban design of the Byzantine Empire, Slavic States, Islam, and Western Europe from the Early Christian to the Gothic era. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Gothic Architecture.** The development of architecture and urban design in Europe from the end of the Romanesque period to the Renaissance. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
313. **Italian Renaissance and Baroque Architecture.** The development of architecture, urban design, and garden art in Italy from the early fifteenth century to the late eighteenth century. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **French Architecture, 1500-1800.** The development of architecture, urban design, and landscape architecture in France from the early sixteenth century to the late eighteenth century; French influence in the rest of Europe. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
315. **English and American Architecture.** Major architectural developments in Great Britain in the sixteenth, seventeenth, and eighteenth centuries; regional building traditions; and sources and development of colonial architecture in America. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Architecture of the Nineteenth and Twentieth Centuries.** The development of architecture and urban design in Europe and the Americas from 1800 to the present with special consideration given to the influence of technology and urban conditions. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

317. **The Development of Contemporary Architectural Thought.** An examination of the philosophy of significant architectural writers and architects in relation to their projects and executed work; those studied include Wright, Gropius, Le Corbusier, Mies van der Rohe, Ruskin, Pugin, Blondel, Laugier, Lodoli, Palladio, Alberti, and Vitruvius. Prerequisite: Architecture 211 and 212, or Art 111 and 112; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
323. **Social and Behavioral Factors for Design.** A research-oriented introduction to existing social and behavioral knowledge, methods, and tools for relating man to his physical and social environment, with implications for theories and a philosophy of architectural design. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Impact of Technology on Design.** Studies of the effects of emerging technologies upon the development of the physical environment; examinations of alternative futures. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
330. **Architectural Practice.** Discussion of the role of the architect, the conduct of professional practice, and professional ethics; office and business procedures; building economics and cost control; contracts and contract documents; legal aspects of professional practice and building construction; and the administration of construction contracts and supervision of construction. Prerequisite: Architecture 232. 3 hours or $\frac{3}{4}$ unit.
331. **Design Development and Construction Documents.** To be taken with Architecture 374. Network diagram scheduling of professional services; preliminary project investigations of site conditions and facilities, building law, and economic considerations; the integration of materials, structure, mechanical equipment, illumination, and acoustics; design development outline specifications and drawings; the production planning, scheduling, and budgeting for working drawings and specifications; and preparation of portions of these documents. Prerequisite: Architecture 330; concurrent registration in Architecture 374. 3 hours or $\frac{3}{4}$ unit.
351. **Theory and Design of Metal Structures.** Analysis and design of structures in metal; beams; open-web joists; metal deck; columns; riveted, bolted, and welded trusses; plate girders and connections; lateral loads and bracing; and design of a simple steel frame building. Prerequisite: Architecture 252. 4 hours or 1 unit.
352. **Theory of Reinforced Concrete.** Concrete materials; behavior of reinforced concrete construction; behavior and design of structural elements, one-way slabs, beams, and girders; columns; ACI code requirements; and introduction to continuity in reinforced concrete structures. Prerequisite: Architecture 351. 3 hours or $\frac{3}{4}$ unit.
353. **Reinforced Concrete Design.** Selection, design, and comparison of reinforced concrete floor systems for buildings; study and design of columns and footings; and prestressed concrete. Prerequisite: Architecture 352. 4 hours or 1 unit.
354. **Structural Planning.** General problems in the selection and design of structural systems for buildings; methods of analysis; site explorations, soils, and foundations; bracing; and special systems. Prerequisite: Architecture 353. 4 hours or 1 unit.
355. **Structural Analysis.** Advanced problems in the analysis of statically determinate structures; general theories and methods of analysis of statically indeterminate structures by geometric and energy methods; and introduction to theory of plastic design. Prerequisite: Architecture 353. 4 hours or 1 unit.
371. **Architectural Design Studio, I.** Development of skills required in the design and representation of a complete architectural project; exercises in the design of the simplest architectural spaces and elements in relation to their next larger context of site and surroundings. Studio with two theory lectures per week. Prerequisite: Architecture 272 or consent of instructor. 5 hours or $1\frac{1}{4}$ units.
372. **Architectural Design Studio, II.** Design of the simplest building types; relationships within the human habitat at the neighborhood scale; structural and tectonic integration; and ecological and environmental influences. Studio with two theory lectures per week. Prerequisite: Architecture 371. 5 hours or $1\frac{1}{4}$ units.
373. **Architectural Design Studio, III.** Design studies of intermediate-size building types; planned communities; civic and social facilities at the community and urban scale; and

collaboration among the several disciplines involved in planning the human habitat: urban planning, landscape architecture, sociology, and economics. Studio with two theory lectures per week. Prerequisite: Architecture 372. 6 hours or 1 1/2 units.

374. **Architectural Design Studio, IV.** Research and individual comprehensive design study for a selected architectural project; special emphasis on site development and the integration of construction technology, structure, and environmental systems. Studio with two theory lectures per week. Prerequisite: Architecture 373; concurrent registration in Architecture 331. 6 hours or 1 1/2 units.
379. **Urban Housing.** A study of housing needs, comparative means of financing, comparative building types and costs, and contemporary examples of public and private housing in Europe and the United States. Prerequisite: Consent of instructor. 2 hours or 1/2 unit.
421. **Environmental Control.** Same as Mechanical Engineering 421. Design of environmental systems for buildings; integration of mechanical, structural, and architectural demands in lectures and through a semester design project. Prerequisite: Undergraduate courses in heat transfer and fluid mechanics. 1 unit.
431. **Advanced Architectural Practice, I.** Comprehensive and critical analysis of that part of professional practice related directly to the construction of buildings; the building industry; policy, organization, procedures, and techniques for construction management; the architect, the owner, and the contractor; and administration of the construction contract. Prerequisite: Architecture 331 or consent of instructor. 3/4 unit.
432. **Advanced Architectural Practice, II.** Comprehensive and critical analysis of that part of professional practice related to the organization of the architectural firm and conduct of the internal aspects of business; administrative policy and management functions and procedures; and general development, production, personnel, finance, insurance, accounting, and cost control. Prerequisite: Architecture 331 or consent of instructor. 3/4 unit.
433. **Architectural Design Methods.** Examination of the architectural design process; identification, investigation, and evaluation of design methods. Prerequisite: Consent of instructor. 1/2 unit.
434. **Building Economics.** The principles of economics as they apply to individual and large-scale building projects; factors affecting the cost of buildings: the building market, building investment and finance, land acquisition, and the effect of government assistance, leadership, and control; first costs, operating costs, and ultimate costs; cost analysis and cost models; and construction costs, estimates, and cost control. Prerequisite: Architecture 331 or consent of instructor. 3/4 unit.
436. **Theory of Materials and Systems Selection.** The principles of decision theory as they apply to the architectural design process in the selection of materials, products, methods, and systems of building construction; factors affecting decision making: function, cost, and aesthetics; and defining the problem, developing alternatives, and final decision. Prerequisite: Architecture 434 or consent of instructor. 3/4 unit.
451. **Advanced Structural Analysis.** Advanced theory and methods of analysis of statically indeterminate structures; secondary stresses; torsion; buckling and stability; and advanced theory and application of plastic design in building structures. Prerequisite: Architecture 355 or consent of instructor. 1 unit.
452. **Foundation Engineering.** Soil mechanics and site exploration; design of spread footings, combined footings, piles, and caissons; and foundation walls and retaining walls in reinforced concrete. Prerequisite: Architecture 355 or consent of instructor. 1 unit.
453. **Advanced Reinforced Concrete Design.** Critical review of the analysis, methods, and specifications involved in the design and behavior of reinforced concrete structures for buildings, including tall buildings, plates, and shells; computer applications. Prerequisite: Architecture 355; credit or concurrent registration in Architecture 451 or consent of instructor. 1 unit.
454. **Advanced Steel Design.** Advanced topics in the design of steel structures; critical study of the AISC specification; design of steel members and their connections; composite

structures; and analysis and design of continuous structures and tall buildings. Prerequisite: Architecture 451 or consent of instructor. 1 unit.

455. **Prestressed Concrete Design.** Theory and design of prestressed concrete structures; suspension shell structures. Prerequisite: Architecture 453 or consent of instructor. 1 unit.
456. **Advanced Structural Planning.** Study of the loads, functional and spatial requirements, and construction problems in the selection and design of structural systems for buildings; cost estimates; and integration of mechanical and electrical equipment. Prerequisite: Architecture 452 or 453; credit or concurrent registration in Architecture 454 and 455, or consent of instructor. 1 unit.
471. **Architectural Design Studio, V.** Definitive design of various building types with optional choices related to the student's particular interests, talents, and capacities; emphasis on human need, structural, mechanical, and tectonic integration. Prerequisite: Architecture 374 or consent of instructor. 1 ½ units.
472. **Architectural Design Studio, VI.** Continuation of Architecture 471. Prerequisite: Architecture 471 or consent of instructor. 1 ½ units.
477. **Architectural Design Theory.** A review of principles of architectural design; factors in programming architectural requirements; design development; and evaluation and criticism. Prerequisite: Architecture 374 or consent of instructor. ¾ unit.
478. **Architectural Design Seminar.** Analysis and criticism of selected buildings; individual reports and discussions. Prerequisite: Architecture 477 or consent of instructor. ¾ unit.
481. **Urban Design Studio, I.** Design of large building types and building complexes; megastructures; and collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 374; credit or concurrent registration in Urban Planning 394 or consent of instructor. 1 ½ units.
482. **Urban Design Studio, II.** Design development studies of central business districts, movement systems, and residential communities; collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 481 or Urban Planning 384, or consent of instructor. 1 ½ units.
488. **Urban Design Seminar.** Analysis and criticism of urban development projects; individual reports and discussions. Prerequisite: Architecture 374 or Urban Planning 384, or consent of instructor. ¾ unit.
491. **Special Problems in Architectural History.** Individual investigation of the work of particular architects, of specific buildings, and of the architecture of periods or regions; comparative studies; and aesthetic problems. Prerequisite: Twelve hours of architectural history or consent of instructor. ½ to 2 units.
493. **Special Problems in Architectural Administration and Building Construction.** Studies of building projects at large and small scales; investigations in feasibility and cost control, material and system selection, construction techniques and processes, legal and business procedures, and related aspects of professional practice; and independent study or study in conjunction with architectural and urban design projects. Prerequisite: Architecture 331 or consent of instructor. ¾ to 3 units.
495. **Special Problems in Structural Theory and Design.** Individual or group investigation and study in architectural engineering application; research in economy and design in correlation with architectural, mechanical, and structural requirements. Prerequisite: Consent of instructor. ½ to 3 units.
497. **Special Problems in Architectural Design.** Individual investigation of building types and systems, aesthetic theories, and other problems in architectural design. Prerequisite: Architecture 374 or consent of instructor. ¾ to 3 units.
498. **Special Problems in Urban Design.** Individual investigation of problems at the community and urban scale; collaboration with other disciplines. Prerequisite: Credit or concurrent registration in Architecture 481 or Urban Planning 384, or consent of instructor. ¾ to 3 units.

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ART AND DESIGN

Head of Department: Professor J. R. Shipley

Department Office: 143 Fine and Applied Arts Building, Champaign

105. **Introduction to Watercolor Painting.** Elementary watercolor sketching from landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.
106. **Introduction to Oil Painting.** Elementary oil painting and sketching from still life and landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.
107. **Elementary Drawing.** Practical problems in elementary drawing as applied to solids, line drawing, light and shade, and outdoor and studio sketching. For students not majoring in art. 2 hours. May be repeated for 2 additional hours.
110. **Introduction to Non-Western Art: Africa, the Americas, and Oceania.** Highlights of visual arts traditions in black Africa, pre-Columbian America, and the South Pacific; a cross-cultural analysis of non-Western aesthetic systems and forms with a focus on thematic problems rather than style surveys. 3 hours.
111. **Introduction to Ancient and Medieval Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies previous to the Italian Renaissance. 4 hours.
112. **Introduction to Renaissance and Modern Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies beginning with the Italian Renaissance and continuing through the Modern period. Prerequisite: Art 111 or consent of instructor for art students. 4 hours.
113. **Orientation to Art.** Information about the various fields of practice in the visual arts, and elementary theoretical concepts; to enrich the student's knowledge of the visual arts and to broaden his appreciation of other art forms. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 1 hour.
114. **Orientation to Art.** Continuation of Art 113. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 1 hour.
115. **Art Appreciation.** An introduction to the factors inherent in architecture, sculpture, painting, and the other arts. Primarily for nonart students. 3 hours.
116. **Masterpieces of Art.** A presentation of selected masterpieces of the visual arts, both as outstanding documents of culture and as great achievements in art. 2 hours.
117. **Drawing, I.** Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 3 hours.
118. **Drawing, II.** Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 117. 3 hours.
119. **Design, I.** Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 3 hours.
120. **Design, II.** Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 119. 3 hours.
121. **Drawing Theory.** Orthographic, oblique, and isometric projections and perspective. 2 hours.
122. **Drawing Theory.** Continuation of Art 121. The science of shades and shadows in orthographic, oblique, and isometric projections and perspective. Prerequisite: Art 121. 2 hours.
123. **Fundamentals of Drafting and Drawing.** Drawing techniques, lettering, projections, perspective, and special problems. Primarily for students in occupational therapy and home economics. Prerequisite: Consent of instructor. 3 hours.
125. **Life Drawing.** Prerequisite: Art 118. 2 hours.

126. **Life Drawing.** Prerequisite: Art 125. 2 hours.
129. **Anatomy, I.** Lecture and studio practice in the skeletal and muscular structure of the human figure. Prerequisite: Art 118. 2 hours.
130. **Anatomy, II.** Continuation of Art 129. Prerequisite: Art 129. 2 hours.
131. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 119. 2 hours.
132. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 131. 2 hours.
133. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Freshman standing in art. 2 hours.
134. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Art 133. 2 hours.
135. **Introduction to Photography.** Basic investigation of elements comprising a photograph; exploration of the photogram, tone, and texture as expressive media; and work with the camera, exposure meter, and film and print developing. Work is in black and white. Average cost: \$100 plus cost of required camera. Prerequisite: Freshman standing in art or consent of instructor. 3 hours.
141. **Still Life.** Painting in oil from arranged groups. Prerequisite: Freshman standing in art. 2 hours.
142. **Still Life.** Continuation of Art 141. Prerequisite: Art 141. 2 hours.
150. **Beginning Sculpture.** Clay modeling from the human figure; casting in plaster and other materials as well as production of sculpture involving materials other than plaster and clay. Not open to students majoring in art. 2 hours.
151. **Sculpture.** Anatomical and ornamental forms; plaster molds and models; and wood and stone sculpture. Prerequisite: Freshman standing in art. 2 hours.
152. **Sculpture.** Continuation of Art 151. Prerequisite: Art 151. 2 hours.
159. **Graphic Design Skills, I.** Graphic design laboratory projects emphasizing contemporary production and presentation techniques; study of photographic, silkscreen, typographic, model making, and other processes unique to current professional demands. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. 2 hours.
160. **Graphic Design Skills, II.** Continuation of Art 159. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. 2 hours.
161. **Calligraphic Design.** A history and analysis of calligraphic form and its aesthetic and communicative potential; application of fundamental design principles and the effect of color, line, and texture as organizational elements; and practice in the various calligraphic hands. Prerequisite: Sophomore standing in art. 2 hours.
162. **Letterform Design.** The history and use of the letter as a tool for verbal communication; study of the typographic form, its construction, and utilization. Practice ranges from indication of lettering through finished lettering and includes organization of page, consideration of layout, readability, scale, texture, and color. Prerequisite: Sophomore standing in art. 2 hours.
175. **Design Methodology.** Introduction to logical methods and systems; review of current theory; investigation of quantitative factors in design; application of systems theory to design problems; short problems; and required reading outside of class. Prerequisite: Sophomore standing. 2 hours.
185. **Design.** Composition in line, pattern, monochrome, and color. For nonart majors. 2 hours.
186. **Design.** Continuation of Art 185. For nonart majors. Prerequisite: Art 185. 2 hours.
188. **Individual Projects.** Individually directed projects in various media. Not open to students majoring in art. Prerequisite: Consent of instructor. 2 to 4 hours. May be repeated for a total of 6 hours.
190. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for

recreation majors in physical education. Credit is not given for both Art 190 and 203. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

191. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Prerequisite: Art 190. 2 hours.
192. **Metalwork and Jewelry, I.** The design and execution of simple jewelry, flatware, and holloware, including study of the characteristics of base and precious metals and stones and working experience in the basic forming, decorating, jointing, and finishing processes. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
193. **Metalwork and Jewelry, II.** Advanced work in the design and production of jewelry, flatware, and holloware with emphasis on the development of related or complicated pieces. Manipulative techniques are expanded and experimentation with materials and processes is encouraged. Prerequisite: Art 192. 2 hours.
194. **Pottery, I.** The design and production of pottery by hand methods. Work covers the basic processes of forming, decorating, and firing. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
195. **Pottery, II.** Advanced work in studio pottery, including expanded experience in forming methods and glaze compounds. Prerequisite: Art 194. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Senior Honors in Art.** For candidates for honors in art. Independent guided study and research in a selected area of art. Prerequisite: Senior standing in art, a University grade-point average of 4.0, and approval of curriculum adviser and head of department. 2 to 5 hours. May be repeated to a total of 5 hours.
201. **Watercolor, I.** Prerequisite: Art 118 and 120. 2 hours.
202. **Watercolor, II.** Continuation of Art 201. Prerequisite: Art 201. 2 hours.
203. **Art in the Elementary Grades, I.** Introductory laboratory experiences with the elements of design in the visual arts and with processes, materials, and activities appropriate for the elementary grades. For nonart students only. Credit is not given for both Art 203 and 190. 3 hours.
204. **Art Education Laboratory.** Art in the secondary school; creative activities in a variety of art materials appropriate for use in the high school; and class discussion on teaching techniques. Prerequisite: Art 132 or junior standing. 2 hours.
205. **Art in the Elementary Grades, II.** A continuation of laboratory experiences begun in Art 203 with processes, materials, and activities appropriate for the elementary grades. For nonart students only. Prerequisite: Art 203. 3 hours.
206. **Creative Art for Children.** Theories and techniques of teaching art to children; supervised teaching experience with children required. Prerequisite: Junior standing in art education or consent of instructor. 3 hours.
207. **Art Curriculum Development and Practicum in the Elementary Schools.** Develops productive and appreciative art curricula for the elementary schools and provides class members with a weekly half-day visitation to the local elementary schools to observe and assist classroom teachers and art consultants in teaching art to children. For art education majors only. 3 hours.
208. **Organization of Public School Art Programs.** The selection and arrangement of content for different educational levels; study and evaluation of curricula, equipment, and supplies; and program supervision. Prerequisite: Art 207 or junior standing in art, or consent of instructor. 3 hours.
209. **Japanese Arts Workshop.** The study and practice of the traditional Japanese arts: sumi-e (ink painting), ikebana (flower arrangement), and tea ceremony. Prerequisite: Sophomore standing. 2 hours.
210. **History of Furniture and Interior Design.** A historical study of furniture and interiors from the Renaissance to the present day; special emphasis upon the American development and the contemporary scene with reference to its technological and historical background. Prerequisite: Sophomore standing. 2 hours.

211. **The Art of Industrialized Society.** An examination of the art of contemporary Western society in relation to the philosophical, political, and physical forces which produced and were altered by the Industrial Revolution. Prerequisite: Junior standing or consent of instructor. 2 hours.
212. **Art of the Ancient Near East.** Survey of architecture, sculpture, and painting of the major areas of the Near East before the time of Alexander the Great, focusing on Egypt and Mesopotamia. 3 hours.
213. **African Art.** An investigation of the characteristics and achievements of outstanding phases of the art of Africa. Prerequisite: One year of history of art or consent of instructor. 3 hours.
215. **Basic Photography, I.** Continued exploration of photography as a creative medium with investigation of light, multiple exposure, reflections, and forms; use of the view camera stressed as a mode of self-expression. Work is in black and white. Most equipment is furnished. Estimated cost: \$100 for supplies. Prerequisite: Art 135. 3 hours. May be repeated with consent of instructor for an additional 3 hours.
216. **Basic Photography, II.** Intermediate study for the use of photography as a tool to express ideas, emotions, etc.; students may relate the photographic image to their specific area of academic study; and stress on personal development of self-expressive attitudes. Estimated cost: \$125 for supplies. Prerequisite: Art 215. 3 hours. May be repeated with consent of instructor for an additional 3 hours.
217. **Greek Art.** Survey of architecture, sculpture, and painting of the Greek world from the geometric period to the beginning of the Christian era. 3 hours.
218. **Roman Art.** Survey of architecture, sculpture, and painting of the Roman world from republican times to the age of Constantine, with brief treatment of later Roman art leading to Byzantine. 3 hours.
219. **Italian Renaissance Art.** Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. Prerequisite: One year of history of art or consent of instructor. 3 hours.
220. **Northern Renaissance Art.** Architecture, painting, sculpture, and minor arts of Europe outside Italy in the fifteenth and sixteenth centuries. Prerequisite: One year of history of art or consent of instructor. 3 hours.
221. **Art of the Nineteenth Century.** Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the nineteenth century. Prerequisite: One year of history of art or consent of instructor. 3 hours.
222. **Latin American Art.** A study of the more important phases and periods of the visual arts of Latin America. Prerequisite: One year of history of art or consent of instructor. 3 hours.
223. **Italian Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in Italy in terms of major figures and dominant stylistic tendencies. Prerequisite: One year of history of art or consent of instructor. 3 hours.
224. **Northern European Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in the low countries, France, England, and Spain in terms of major figures and dominant stylistic developments. Prerequisite: One year of history of art or consent of instructor. 3 hours.
225. **Intermediate Drawing.** Study from life in drawing media. Prerequisite: Junior standing in art. 2 hours.
226. **Intermediate Drawing.** Continuation of Art 225. Prerequisite: Art 225. 2 hours.
231. **Intermediate Composition.** Prerequisite: Art 132. 3 hours.
232. **Intermediate Composition.** Prerequisite: Art 231. 3 hours.
233. **Advanced Composition.** Prerequisite: Art 232. 3 hours.
234. **Advanced Composition.** Prerequisite: Art 233. 3 hours.
235. **Illustration.** Problems in the design and execution of book and periodical illustration. Prerequisite: Art 132. 2 hours.

236. **Illustration.** Continuation of Art 235. Prerequisite: Art 235. 2 hours.
243. **Figure Painting.** Painting in oil from the head and full figure. Prerequisite: Junior standing in art. 2 hours.
244. **Figure Painting.** Continuation of Art 243. Prerequisite: Art 243. 2 hours.
245. **Advanced Painting and Drawing.** Advanced creative study from nature and the model in various painting and drawing media. Prerequisite: Art 226 and 244. 3 hours.
246. **Advanced Painting and Drawing.** Continuation of Art 245. Prerequisite: Art 245. 3 hours.
247. **Special Problems.** Special problems in technique, creative production, and painting philosophy. Prerequisite: Senior standing in painting or consent of instructor. 2 hours.
248. **Special Problems.** Individually assigned studio projects. Students may be permitted to enroll in a maximum of two sections of this course simultaneously with different instructors during any semester. Prerequisite: Junior standing in art or consent of head of department; consent of instructor. 2 to 4 hours. May be repeated for a total of 8 hours.
253. **Intermediate Sculpture, I.** A free, experimental, and creative use of permanent and impermanent sculpture materials; clays, wood, pastelines, and plasters. Prerequisite: Art 152. 2 hours.
254. **Intermediate Sculpture, II.** Special projects in stone carving and malleable sheet metal; lead, copper, brass, and aluminum. Prerequisite: Art 253. 2 hours.
255. **Sculpture Materials and Techniques, I.** Special projects for cast bronze; model preparations, investments, melting, pouring, chasing, and developing of patinas. Prerequisite: Art 152; junior standing in curriculum in sculpture. 3 hours.
256. **Sculpture Materials and Techniques, II.** Special projects in terra cotta; use of various clays; preparation and construction methods; special problems in casting methods and materials; kiln operation; fuels; and glazing. Prerequisite: Art 255. 3 hours.
257. **Advanced Sculpture, I.** Introduction to plastics and welded metals; projects utilizing the special qualities of these materials. Prerequisite: Art 254. 2 hours.
258. **Advanced Sculpture, II.** Projects in permanent materials; special attention given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 257. 2 hours.
259. **Advanced Sculpture Materials and Techniques, I.** Projects in various permanent materials; special attention given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 256. 3 hours.
260. **Advanced Sculpture Materials and Techniques, II.** Continuation of Art 259. Prerequisite: Art 259. 3 hours.
262. **Sequential Visual Organization.** Organization of visual material sequentially, through specific problems and experiments incorporating time, space, and motion, accomplished through the use of multiple slide projection, the motion picture, and videotape. Prerequisite: Junior standing in graphic design curriculum. 2 hours.
263. **Reproduction Graphics.** Basic information and current practice in methods of producing multiple printed communication, including the preparation of artwork for the various methods of reproduction. Field trips required. Prerequisite: Junior standing in graphic design. 2 hours.
265. **Graphic Design, I.** Emphasis on the solving of basic visual communication problems on an applied level; stress on understanding of symbol and image in evoking viewer response; application of the findings of related fields such as sociology, communication, advertising, marketing, etc., as key factors affecting the solving of problems in design; and introduction to print, film, display media, production methods, and the preparation of art work for reproduction. Prerequisite: Art 161 and 162 for graphic design majors; junior standing in art or consent of instructor for others. 3 hours.
266. **Graphic Design, II.** Continuation of Art 265. Prerequisite: Art 265. 3 hours.
267. **Graphic Design, III.** Continuation of Art 266. Further exploration of diverse design media and communication techniques; strong emphasis on the multipart design problem: the advertising campaign, corporate image program, educational and information material display and exhibit design, and books and films; group and team projects sim-

ulate actual practice, sometimes with students from other disciplines, and result in both verbal and nonverbal presentations; more concentrated involvement in problem definition and analysis and the encouragement of reappraisal of traditional media and methods. Prerequisite: Art 266. 3 hours.

268. **Graphic Design, IV.** Continuation of Art 267. Senior thesis. Preparation of portfolio. Prerequisite: Art 267. 3 hours.
269. **Senior Graphic Design Project.** Individually directed project in visual communication emphasizing interdisciplinary approach and research methodology; project definition and structure by student in consultation with advisers. Prerequisite: Senior standing in graphic design. 2 hours. May be repeated for 2 additional hours.
271. **Materials and Processes.** Use and manipulation of basic materials in modern industry. Prerequisite: Art 122 and 175. 3 hours.
272. **Materials and Processes.** Use and manipulation of basic materials in modern industry. Prerequisite: Art 271. 3 hours.
275. **Industrial Design.** Designing of objects for manufacture by the machine industries. Field trip required. Prerequisite: Art 122 and 175. 3 hours.
276. **Industrial Design.** Continuation of Art 275. Field trip required. Prerequisite: Art 275. 3 hours.
277. **Advanced Industrial Design.** Prerequisite: Art 276. 5 hours.
278. **Advanced Industrial Design.** Prerequisite: Art 277. 5 hours.
283. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
284. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Art 283. 2 hours.
285. **Lithography.** A studio course in lithography comprised of black and white and multiple-color printing on both stones and metal plates; work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
286. **Lithography.** A studio course in lithography comprised of black and white and multiple-color printing on both stones and metal plates; work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Art 285. 2 hours.
288. **Glassworking, I.** The design and production of glasswork by the offhand methods; work covers the basic processes of blowing and molding. Prerequisite: Art 134; junior standing in art or consent of instructor. 2 hours.
289. **Glassworking, II.** Advanced work in glassworking by the offhand methods including blowing, casting, fuming, and acid etching. Prerequisite: Art 288. 2 hours.
290. **Ceramic Raw Materials.** An introduction to the nature and understanding of basic inorganic raw materials in relation to ceramic processes; laboratory testing of clay types, bodies, slips of earthenware, stoneware, and porcelain temperatures. Prerequisite: Junior standing in curriculum in crafts or consent of instructor. 2 hours.
291. **Creative Metalwork Technology.** Understanding of the working properties of a number of nonferrous metals, their alloys, and their patination; such areas as electroforming on organic and inorganic materials, working with rigid and thermosetting plastics, and experimentation with little known processes of metalwork to be subjects of individual research. Prerequisite: Junior standing in crafts or consent of instructor. 2 hours.
292. **Introduction to Metal Design in Jewelry.** Emphasis on the basic techniques of cutting, forming, filling, soldering, and finishing of silver and other metals and materials; design emphasis guides toward the development of forms appropriate to creative jewelry. A free and inventive approach to the use of new materials is encouraged, coupled with a respect for the fundamentals of craftsmanship. Prerequisite: Junior standing in curriculum in crafts. 3 hours.

293. **Development of Metal Design in Jewelry.** Greater technical manipulation of tools and materials along with the designing of more complex challenging units of jewelry in silver, gold, and other materials; casting, repousse, and other appropriate techniques serve to develop a greater three-dimensional emphasis. Prerequisite: Art 292. 3 hours.
294. **Ceramic Design, I.** Introduction to ceramic design for developing basic skills in designing and producing clay products by various hand processes including throwing, hand-building, and casting. Prerequisite: Junior standing in curriculum in crafts. 3 hours.
295. **Ceramic Design, II.** Introduction to ceramic glaze calculation; concern with the understanding and application of the knowledge of glaze calculation in a creative way and with applications of creative experiments in glaze and clay bodies. Prerequisite: Art 294. 3 hours.
296. **Decorative Metal Techniques.** Independent personal development in the techniques of chasing, engraving, filigree, inlaying, enameling, and lapidary design with emphasis on linear and textural surface decoration as applied to small metal forms. Prerequisite: Art 293. 5 hours.
297. **Construction of Hollow and Flatware in Silversmithing.** Experimentation and development in silver, bronze, copper, and other metals of hollow forms such as bowls, cups, and tea and coffee servers; work in flatware includes the design and construction of table services and other appointments. Prerequisite: Art 296. 5 hours.
298. **Ceramic Design, III.** The application of the combined skills of throwing and creative glaze procedures to produce thrown ceramic products with the emphasis on creative experimentation; also covers plaster and mold making as a creative procedure in producing clay products. Prerequisite: Art 295. 5 hours.
299. **Ceramic Design, IV.** Technical and creative research in ceramic design, with emphasis on reappraisal of the traditional media and the traditional limited production method used by artist potters. Prerequisite: Art 298. 5 hours.
301. **Greek Painting.** Vase paintings, wall paintings, mosaics, and other examples of the graphic art of the Greek world from Mycenaean times through the Hellenistic period. Prerequisite: Art 217 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
303. **Art of the Eastern and Western Roman Empire.** Deals with monuments outside Italy both in the eastern and western parts of the empire; emphasis on the influence of native traditions and the development of local styles. Prerequisite: Art 218 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
304. **Greek Sculpture.** A survey of the development of Greek sculpture from Mycenaean times to the Christian Era with analysis of the major works in relief and in the round. Prerequisite: Art 217 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
305. **Art of the Augustan Age.** A study of the major works of architecture, sculpture, and painting in Italy and the Roman Empire from the time of Augustus. Prerequisite: Art 218 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Romanesque Art.** Art and architecture of the Romanesque period. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
308. **Early Medieval Art.** The arts of Byzantine and of western Europe from the early Christian Era through the Romanesque period. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
309. **Gothic Art.** The arts of western Europe from the end of the Romanesque period until the Renaissance. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
310. **History of Printmaking.** Variations and artistic developments in fine prints from the fifteenth century to the present; an art historical survey, but emphasis included on techniques, aesthetics, connoisseurship, and personal contact with original examples. Enrollment limited. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **German and Austrian Painting of the Late Nineteenth and Early Twentieth Centuries.** A survey of modern German and Austrian painters and pictorial movements from the 1890s to the period of Hitler, with special emphasis on the expressionist period. Pre-

requisite: Art 321 or 322, or one 300-level course in nineteenth-century painting. 3 hours or $\frac{3}{4}$ unit.

312. **The Art Nouveau in Europe.** A survey of the principal artists and artistic currents in the applied arts during the 1890s in Europe; emphasis on individual figures, with an attempt to define the common stylistic and theoretical assumptions of the period. Prerequisite: Art 321 or one 300-level course in nineteenth-century art or architecture. 3 hours or $\frac{3}{4}$ unit.
313. **Problems in Italian Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of Italy during the Renaissance selected for intensive study; special emphasis given to the study of the lives of artists and problems in style or iconography. Prerequisite: Art 219 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **Problems in Northern Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of France, Germany, Spain, and England during the Renaissance selected for intensive study; special emphasis given to the study of the lives of the artists and problems in style or iconography. Prerequisite: Art 220 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Later Chinese Painting.** A study in depth of later phases of Chinese painting, particularly that of the Ming and Ch'ing dynasties; connoisseurship in Chinese painting. Prerequisite: Art 328 or a course in Chinese history of the period covered, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
317. **Italian Art of the Sixteenth Century.** Painting, sculpture, and minor arts in Italy from 1520 to 1590. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
318. **Latin American Art.** A study of the more important phases and periods of the visual arts of Latin America. 3 hours or $\frac{3}{4}$ unit.
321. **Twentieth-Century Art in Europe: 1900-1914.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on the painting. Prerequisite: One year in the history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Twentieth-Century Art in Europe: 1915-45.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on painting. Prerequisite: One year in the history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
323. **American Art to 1840.** Architecture, painting, sculpture, and minor arts of the colonies and the United States to 1840. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
324. **American Art: 1840-1900.** Architecture, painting, sculpture, and minor arts of the United States. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
325. **Recent American Painting and Sculpture.** Current developments, with special emphasis on works shown in contemporary exhibitions at the Krannert Art Museum. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Art of Medieval Japan.** A study of Japanese art, primarily painting, from the thirteenth century, with emphasis on the work of individual artists. Prerequisite: Art 327 or a course in Japanese history of the period covered, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
327. **Japanese Art.** History of Japanese art from earliest times to the twentieth century. Prerequisite: One year of history of art or junior standing. 3 hours or $\frac{3}{4}$ unit.
328. **Chinese Art.** History of Chinese art from earliest times to the present. Prerequisite: One year of history of art or junior standing. 3 hours or $\frac{3}{4}$ unit.
330. **Oceanic Art.** A survey of traditional art in Polynesia, Melanesia, and Micronesia, including New Zealand and Australia; emphasis on major style areas and their historical and cultural significance. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

331. **West African Art.** A study in depth of West African art styles in time perspective and cultural context, with a special interest in the use of interdisciplinary source materials. Prerequisite: Art 213 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
332. **The Ancient Ideal in Art and Literature.** Same as Classical Civilization 332. A study of the aesthetic standards and theories of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
334. **Old Master Drawings.** An historical and critical survey of drawings from the late Middle Ages to the end of the nineteenth century; emphasis on drawings by artists such as Pisanello, Leonardo, Michelangelo, Raphael, Rembrandt, Rubens, Watteau, Goya, Degas, and Van Gogh. Prerequisite: One year of history of art or consent of instructor. 3 hours or 1 unit.
335. **Romantic Art.** A study of English, French, and German art from the end of the eighteenth century through 1840; focuses on revivalist movements, historicism, landscape art, and changing conceptions of art and artist during the period. Prerequisite: Art 221 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
336. **Realism to Post-Impressionism.** A study of European art from 1850 to 1900, with emphasis on French painting. Prerequisite: Art 221 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
340. **Historiography of Art and the History of Art Criticism.** Origins and the development of the history of art criticism. Prerequisite: A year of study in the history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
341. **Introduction to Art Museology.** Survey of the art museum as a professional institution, its history, and present orientation; designed to acquaint prospective graduate students with the field of museum operation and to serve as background for students entering graduate courses in special fields of art museum practice (museology). Prerequisite: Consent of instructor. 4 hours or 1 unit.
380. **Drawing.** Advanced drawing in several media. Prerequisite: For undergraduates, consent of instructor; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
381. **Painting.** Advanced painting in oil and other media. Not open to candidates for the M.F.A. in painting. Prerequisite: For undergraduates, Art 142 or equivalent; for graduates, consent of departmental graduate committee. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a total of 2 units.
382. **Painting Materials and Techniques.** Study of the materials and techniques used in the various media: oil, watercolor, tempera, gouache, encaustic, etc. Prerequisite: Art 142 or graduate standing in art. 2 hours or $\frac{1}{2}$ unit.
383. **Print Media.** Advanced work in various printmaking techniques. Not open to candidates for the M.F.A. in painting. Prerequisite: For undergraduates, Art 284 or equivalent; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
385. **Lithography.** Laboratory course in lithography. Course of study includes a complete development of the process, exploiting its potential as a fine art medium. Prerequisite: For undergraduates, Art 286; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
387. **Photography.** Emphasis on development of mature creative attitudes through use of personal images and interpretations; work in black and white and in color. Prerequisite: Art 216 or equivalent; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. May be repeated for a total of 9 hours or 3 units with consent of instructor.
388. **Cinematography.** Theory and practice of motion pictures as an art form; emphasis on individual creative production. The cost to the student is \$75 to \$200. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a total of 9 hours or 3 units.
390. **Advanced Art for Elementary Grades.** Advanced laboratory experiences in two-dimensional visual art techniques for elementary teachers, supervisors, and principals.

Prerequisite: Art 205 or consent of instructor. 2 hours or $\frac{1}{2}$ unit. May be repeated for a total of 4 hours or 1 unit.

391. **Advanced Sculpture Techniques.** Advanced work in various sculptural media. Prerequisite: Art 252 or equivalent. 2 hours, or $\frac{1}{2}$ to 1 unit.
392. **Silversmithing, I.** An advanced course in the design and execution of holloware, dealing primarily with raising and spinning methods and with the decorative processes of chasing, repousse, niello, filigree, and inlay. Prerequisite: Consent of instructor. 2 hours, or $\frac{1}{2}$ to 1 unit.
393. **Silversmithing, II.** An advanced course in the design and execution of flatware and holloware, dealing primarily with forging and seaming methods, engraving, and tool-making. Prerequisite: Consent of instructor. 2 hours, or $\frac{1}{2}$ to 1 unit.
394. **Ceramic Design.** Ceramic design with emphasis on the development of professional style and personal expression. Prerequisite: Art 295 or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 2 units. May be repeated to a total of 6 hours.
395. **Glass Design.** Advanced glass design with emphasis on professional development and personal style. Prerequisite: Art 289 or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
441. **Art Curatorial Techniques.** An intensive course in the role, responsibilities, and duties of the art museum curator; demonstration and practice of curatorial techniques in researching; documenting, acquiring, transporting, handling, and conservation of works of art. Prerequisite: Art 341. 1 unit.
442. **Art Museum Administration and Education.** Two aspects of art museum work: (1) administration, covers trustee relations, methods of serving the public, fund raising, budgeting, staff organization, and program planning; (2) museum education. Students receive practice in the preparation of educational exhibitions and related educational materials. Prerequisite: Art 341. 1 unit. Art 443. Art Museum Internship. Introduction to actual supervised practice in one specialized department in an art museum: curatorial, education, or administration department. Prerequisite: Art 441 and 442. 1 unit.
450. **Seminar in Modern Art.** Investigation of special problems in the history of twentieth-century art. Students present reports of their research. Prerequisite: Consent of instructor. 1 unit.
451. **Seminar in American Art.** Investigation of selected problems in the history of American art. Prerequisite: Art 323 and 324, or consent of instructor. 1 unit.
452. **Seminar in Chinese Art.** Investigation of selected phases, concepts, and problems of the art of China; intensive reading and reports. Prerequisite: Art 328 or consent of instructor. 1 unit.
453. **Seminar in Japanese Art.** Investigation of selected phases, concepts, and problems of the art of Japan; intensive reading and reports. Prerequisite: Art 327 or consent of instructor. 1 unit.
454. **Seminar in Ancient Art.** Research seminar in problems selected from the art of the ancient Mediterranean area. Prerequisite: At least one of the following: Art 304, 305, 306, or 307, or equivalent. 1 unit.
455. **Seminar in Baroque Art.** Research seminar in problems selected from the art of seventeenth-century Europe. Prerequisite: Art 319 or 320, or equivalent; or consent of instructor. 1 unit.
456. **Seminar in the Art of the Period 1750-1900.** An intensive study of selected problems in European art. Prerequisite: Consent of instructor. 1 unit. May be repeated to a total of 3 units.
457. **Studies in Medieval Art.** Research seminar in subjects selected from the art and architecture of the medieval period in western Europe. Prerequisite: Art 308 or 309; effective reading knowledge of French or German; consent of instructor. 1 unit.
458. **Seminar: African Art.** An intensive investigation of selected problems in the sculpture and other arts of Negro Africa. Prerequisite: Consent of instructor. 1 unit.
459. **Seminar in Renaissance Art.** Special problems in the history of Renaissance art. Prerequisite: Consent of instructor. 1 unit.

467. **Graphic Design Laboratory.** Individually directed research in the studio with concentration in graphic design. Prerequisite: Enrollment in the M.F.A. program in graphic design or consent of departmental graduate committee. 1 to 3 units.
477. **Industrial Design Laboratory.** Individually directed research in the drafting room or workshop with concentration on industrial design. Prerequisite: Enrollment in the M.F.A. program in industrial design or consent of departmental graduate committee. 1 to 3 units.
486. **Photography Studio.** Individually directed research; personal expression through the photographic medium. Prerequisite: Enrollment in M.F.A. program and major in photography/cinematography, or consent of the departmental graduate committee. $\frac{1}{2}$ to 2 units. May be repeated for additional credit.
487. **Cinematography Studio.** Individually directed research; expression through the cinematographic medium. Prerequisite: Enrollment in M.F.A. program and major in photography/cinematography, or consent of the departmental graduate committee. $\frac{1}{2}$ to 2 units. May be repeated for additional credit.
490. **Curriculum Development in Art.** An analysis of curriculum organization in the visual arts; particular emphasis given to a range of curriculum positions in education and general research related to curriculum design. Prerequisite: Consent of instructor. 1 unit.
491. **Special Problems.** Individual direction in research and in creative activity; thesis. $\frac{1}{2}$ to 2 units.
492. **Individual Readings in History of Art.** Directed readings in special fields or aspects of history of art not provided in depth by the current course offerings. Prerequisite: Consent of instructor. Sections A and B may be taken simultaneously. Registration allowed for each section is $\frac{1}{2}$ to 1 unit.
493. **Seminar: Introduction to Methods and Criticism.** Prerequisite: Graduate standing in art. $\frac{1}{4}$ to 1 unit.
494. **Seminar: Studies in the Development of Art History and Criticism.** The relation of art history and criticism: changing standards and criteria; intensive reading of selected critical works; and the writing of art criticism. Prerequisite: Consent of instructor. 1 unit.
495. **Painting Laboratory.** Professional and experimental painting with emphasis on the development of maturity of style and personal expression. Prerequisite: Enrollment in the M.F.A. program in painting and printmaking or consent of departmental graduate committee. $\frac{1}{2}$ to 3 units.
496. **Sculpture Laboratory.** Experience at a professional level in sculptural techniques including metals casting, welding, stone carving, wood carving, clay modeling, and ceramic sculpture, with emphasis on the development of creative achievement. Prerequisite: Enrollment in the M.F.A. program in sculpture or consent of departmental graduate committee. 1 to 3 units.
497. **Print Workshop.** Intaglio, relief, and planographic print media; includes etching, engraving, aquatint, wood, paper, and plastic relief printing, and lithography. Prerequisite: Graduate standing in art. $\frac{1}{2}$ to 3 units.
499. **Thesis Research.** Guidance in research and writing theses for advanced degrees. Prerequisite: Graduate standing in history of art or art education. 0 to 4 units.

ASIAN STUDIES

(Including Chinese, Japanese, Korean, Persian, and Sanskrit)

Director of Center: Professor R. B. Crawford

Center Office: Room 202, 1208 West California Avenue, Urbana

All 200-level language courses and Chinese 301 and 302 and Japanese 301 and 302 are open to freshmen.

Asian Studies

- 199. **Undergraduate Open Seminar.** 0 to 9 hours.
- 295. **Readings Course.** Directed readings in the languages and literatures of East Asia, South Asia, Southeast Asia, or the Near East. The area selected depends on the student's interest. Prerequisite: Consent of instructor. 2 to 4 hours.
- 303. **Japanese Society.** Same as Sociology 303. The institutions of contemporary Japan and their historical roots; the Japanese approach to modernization and development and social change; implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
- 345. **Tutorials in Asian Languages.** Same as Linguistics 345. Tutorials at the elementary, intermediate, and advanced levels in special Asian languages not regularly offered are available with the consent of the director of the Center for Asian Studies. May be repeated up to six semesters successively, but no more than 4 units of graduate credit may be accumulated. Graduate credit is given only for work beyond the elementary level. Prerequisite: Consent of director of the Center for Asian Studies. 5 hours or 1 unit.
- 390. **Readings in East Asian Literature.** Guided readings in an East Asian literature in the vernacular with regular individual conferences and a paper. Prerequisite: Reading knowledge of an East Asian language and consent of instructor. 3 hours or 1 unit. May be repeated for a maximum of 6 hours or 2 units.
- 450. **Seminar in Asian Studies.** Seminar on selected Asian and Middle Eastern topics. The topic will vary with the instructor and the seminar may be repeated for a maximum of 3 units. Prerequisite: Consent of instructor. 1 unit.
- 490. **Individual Study and Research in Special Topics.** Supervised individual investigation or study of a topic not covered by regular course offerings. The topic selected by the student and the proposed plan of study must be approved by his Asian studies curriculum adviser and the staff member who supervises the work. Prerequisite: Consent of instructor. 1 to 3 units.

Chinese

- 201. **Elementary Chinese, I.** An introduction to Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
- 202. **Elementary Chinese, II.** Second term of spoken Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Chinese. Prerequisite: Chinese 201. 5 hours.
- 203. **Intermediate Chinese, I.** First term of second year of the Chinese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. Prerequisite: Chinese 202 or 301, or equivalent. 5 hours.

204. **Intermediate Chinese, II.** Concentration on ability to engage in fluent discourse, on comprehensive grammatical knowledge, and on ability to read ordinary simple text in Chinese. Prerequisite: Chinese 203 or equivalent. 5 hours.
207. **Chinese Literature in Translation, I.** An introductory survey of Chinese literature and its cultural and historical background from earliest times to the end of the T'ang. No knowledge of Chinese is required. 3 hours.
208. **Chinese Literature in Translation, II.** An introductory survey of Chinese literature and its cultural and historical background from the end of the T'ang to the present. No knowledge of Chinese is required. Prerequisite: Chinese 207 or consent of instructor. 3 hours.
209. **Chinese Thought, I.** A survey of early Chinese thought before the introduction of Buddhism with emphasis on Confucianism and Taoism. No knowledge of Chinese required. 3 hours.
210. **Chinese Thought, II.** Survey of Chinese thought since the introduction of Buddhism with emphasis on Buddhism, Neo-Confucianism, and the impact of the West. No knowledge of Chinese required. 3 hours.
301. **Intensive Chinese, I.** Intensive introduction to the spoken and written Chinese language; emphasizes the introduction of basic vocabulary and sentence patterns. This course is equivalent to Chinese 201 and 202. For all students who have no previous Chinese and who want to learn at a rapid rate. 10 hours or 2 units.
302. **Intensive Chinese, II.** Continuation of Chinese 301. Emphasizes conversation and reading. This course is equivalent to Chinese 203 and 204. Prerequisite: Chinese 202 or 301, or equivalent. 10 hours or 2 units.
303. **Oral Chinese, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Chinese 204 or 302, or equivalent. 3 hours or 1 unit.
304. **Oral Chinese, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Chinese 303 or consent of instructor. 3 hours or 1 unit.
305. **Advanced Readings in Modern Chinese, I.** Reading and translation of graded selections from modern Chinese literary and journalistic writing. Prerequisite: Two years of modern Chinese. 3 hours or 1 unit.
306. **Readings in Modern Chinese, II.** Reading in modern Chinese literary and journalistic writings; introduction to classical Chinese to prepare students of modern Chinese to understand classical forms and quotations in vernacular text and to use dictionaries and reference works. Prerequisite: Chinese 305 or equivalent. 3 hours or 1 unit.
307. **Introduction to Literary Chinese.** An introduction to literary language, style, and structural patterns as reflected in the Confucian classics and other literary, philosophical, and historical texts. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
308. **Readings in Literary Chinese.** Readings in texts selected from the Confucian classics and other literary, philosophical, and historical texts. Attention is given to linguistic and intellectual patterns and to problems of translation. Prerequisite: Chinese 307 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
309. **Social Science Readings in Chinese.** Reading and translation of selected Chinese texts in the social sciences with emphasis on specialized terminology and prose style. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
310. **Modern Chinese Literature.** Reading and analysis of selected works of Chinese literature since the May 4 Movement with special attention to the relationship between literature and ideology in twentieth-century China. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
311. **The Chinese Novel.** Reading and analysis of representative pieces of Chinese fiction from the fourth century B.C. to 1900 with emphasis on the development of Chinese fiction, its place in the literary tradition, and its role in society. No knowledge of Chinese is required. 3 hours or 1 unit.

312. **Modern Chinese Literature in Translation.** Readings and analysis of representative selections from Chinese literature since the May 4 Movement, with special attention to the relationship between literature and ideology in twentieth-century China. No knowledge of Chinese is required. 3 hours or 1 unit.
315. **Introduction to Colloquial Chinese Literature.** Reading and close analysis of colloquial texts selected from Chinese literature. Prerequisite: Chinese 306 or equivalent. 3 hours or 1 unit.
317. **Introduction to Classical Chinese Literature.** Reading and analysis of classical texts selected from Chinese literature; emphasis on poetry and artistic prose. Prerequisite: Chinese 315 or 307. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Japanese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
350. **Research Methods and Bibliography in Chinese Studies.** Introduction to the problems of translation and to the variety, nature, structure, and usage of Chinese reference works. Exercises are assigned involving application of research methods peculiar to Chinese studies and the use of the appropriate reference aids. Prerequisite: Chinese 307 or consent of instructor. 3 hours or 1 unit.

Japanese

150. **Introduction to Japanese Culture.** A topical introduction to Japanese cultural and aesthetic life with attention to cultural and aesthetic patterns as they are reflected in literature, language, and the arts. 3 hours.
201. **Elementary Japanese, I.** An introduction to Japanese, including conversation with a native Japanese-speaking tutor under the direction of the linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Japanese, II.** Second term of spoken Japanese, including conversation with a native Japanese-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Japanese. Prerequisite: Japanese 201. 5 hours.
203. **Intermediate Japanese, I.** First term of second year of the Japanese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 202 or 301, or equivalent. 5 hours.
204. **Intermediate Japanese, II.** Concentration on ability to engage in reasonably fluent discourse in Japanese, on comprehensive views of formal grammar, and on ability to read simple ordinary written Japanese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 203 or equivalent. 5 hours.
205. **Japanese Literature in Translation, I.** A survey of Japanese literature from earliest times to around 1600 A.D.; readings in prose, poetry, and drama in English translation. 3 hours.
206. **Japanese Literature in Translation, II.** A survey of Japanese literature from around 1600 A.D. to recent times; readings in prose, poetry, and drama in English translation; and lectures and papers. 3 hours.
301. **Intensive Japanese, I.** An intensive introduction to spoken and written Japanese; emphasis on basic grammatical patterns and vocabulary. Equivalent to Japanese 201 and 202; for students who have no previous Japanese and who want to learn at a rapid rate. 10 hours or 2 units.

302. **Intensive Japanese, II.** Continuation of Japanese 301. Emphasis on conversation and reading. Equivalent to Japanese 203 and 204. Prerequisite: Japanese 202 or 301, or equivalent. 10 hours or 2 units.
303. **Oral Japanese, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Japanese 204 or 302, or consent of instructor. 3 hours or 1 unit.
304. **Oral Japanese, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Japanese 303 or consent of instructor. 3 hours or 1 unit.
305. **Readings in Modern Japanese, I.** Reading and translation of selected texts in modern Japanese. Prerequisite: Two years of Japanese. 3 hours or 1 unit.
306. **Readings in Modern Japanese, II.** Continuation of Japanese 305. Reading and translation of selected texts in modern Japanese. Prerequisite: Japanese 305 or equivalent. 3 hours or 1 unit.
309. **Social Science Readings in Japanese.** Readings in Japanese social science materials, including articles from newspapers, periodicals, and learned journals. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
310. **Modern Japanese Literature.** Readings and analysis of selected Japanese texts, primarily fiction. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Korean

330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Persian

201. **Elementary Persian, I.** Introduction to Persian, including conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Persian, II.** Continuation of Persian 201, with introduction of more advanced grammar and with emphasis on more fluency in speaking and reading. Prerequisite: Persian 201 or equivalent. 5 hours.
205. **Introduction to Persian Culture and Literature, I.** A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
206. **Introduction to Persian Culture and Literature, II.** Continuation of Persian 205. A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
303. **Intermediate Persian, I.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 202. 5 hours or 1 unit.
304. **Intermediate Persian, II.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 303. 5 hours or 1 unit.

305. **Advanced Persian, I.** Designed to improve competence in speaking, writing, and reading Persian; includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 304. 3 hours or 1 unit.
306. **Advanced Persian, II.** Continuation of Persian 305. Designed to improve competence in speaking, writing, and reading Persian; includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 305. 3 hours or 1 unit.

Sanskrit

201. **Elementary Sanskrit, I.** Introduction to Sanskrit, treating in full the grammar of the language as preparation for reading, and including the reading sections of the Mahabharata. 5 hours.
202. **Elementary Sanskrit, II.** Continuation of Sanskrit 201. Introduction to Sanskrit, treating in full the grammar of the language as preparation for reading, and including the reading of sections of the Mahabharata. Prerequisite: Sanskrit 201. 5 hours.
309. **Introduction to Sanskrit Literature in English Translation.** Focus on different forms of Sanskrit literature in English translation with emphasis on drama, poetry, and poetics. 3 hours or 1 unit.

ASTRONOMY

Head of Department: Professor I. Iben, Jr.

Department Office: 103 Observatory, Urbana

101. **Descriptive Astronomy.** Introductory survey of the universe; structure and motions of the earth and moon; planetary motions; physical nature of the planets; comets and meteors; and origin and evolution of the solar system. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210 or 300; not open to those students who have had two or more semesters of college physics. 4 hours.
102. **Descriptive Astronomy.** The stars: distances, motions, and dimensions; atoms and radiation; structure, origin, and evolution of stars; structure of the Milky Way; and galaxies and the structure of the universe. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210 or 300. Prerequisite: Astronomy 101. 4 hours.
110. **Selected Topics in Astronomy.** For students who have an interest in astronomy and wish to examine various aspects of the science in more detail than is possible in Astronomy 101 or 102. Topics vary from semester to semester. No credit is given toward major requirements in astronomy; not open to students with credit in Astronomy 210. Prerequisite: Astronomy 102. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
210. **General Astronomy.** A survey of astronomy for students having some background in physics. The approach is primarily descriptive, but mathematical techniques are used where needed. The chief topics are orbits and gravitation; the bodies of the solar system; the nature and evolution of the stars; galaxies; and the structure of the universe. Credit is not given to students who have credit in Astronomy 101, 102, or 300. Prerequisite: Two semesters of college physics. 3 hours.
300. **Astronomy for Teachers.** A general course in astronomy designed for teachers which includes classical astronomy, modern developments, and aspects of the space program; discussion of available curriculum materials for elementary and secondary teaching and some practice given in telescopic observation. Credit is not given to students with credit in Astronomy 101, 102, or 210, or to astronomy majors. Graduate credit is given

only to students in elementary and secondary teacher training programs. 4 hours or 1 unit.

301. **Introductory Astrophysics.** Stars: observational data and their determination; atoms and radiation; stellar atmospheres; equilibrium of stellar interiors; special types of stars; and interstellar matter. Prerequisite: Physics 108. 3 hours or 1 unit.
302. **Astrophysics of the Sun.** Observations of the sun at all wavelengths and application of the results to the study of photosphere, chromosphere, and corona; structure of the atmosphere of the quiet sun; and solar activity. Prerequisite: Astronomy 301. 3 hours or 1 unit.
306. **Foundations of Mechanics and Gravitational Theory.** Same as Aeronautical and Astronautical Engineering 306. Introduction to the dynamics of particles and of rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectiles relative to earth, and precession of earth's axis. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
314. **Observational Astronomy.** Astronomical coordinated systems and transformations; theory of, and practice in, approximate and precise determinations of latitude, longitude, and time; introduction to theory of errors; and theory and practice of astronomical photography. Prerequisite: Astronomy 102 or 210, or Civil Engineering 201; Mathematics 140, 141, or 145. 4 hours or 1 unit.
315. **Observational Techniques and Reductions.** Methods of observations and reductions in photographic and photoelectric photometry, spectrophotometry, and stellar radial velocity determinations. Prerequisite: Astronomy 102 or 210; Mathematics 140, 141, or 145. 4 hours or 1 unit.
317. **Elements of Magnetohydrodynamics.** Same as Aeronautical and Astronautical Engineering 317. Equations of magnetohydrodynamics; single-fluid and multiple-fluid models; magnetic interaction parameters; magnetosonic waves; hydromagnetic shock waves; aligned-field and cross-field flows; theory of characteristics; and MHD acceleration, generation, and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit.
321. **Stellar Systems, I.** Galactic structure: the observational data; stars in the solar neighborhood; the solar motion; stellar statistics and distribution; stellar populations; interstellar matter and spiral structure; and the whole galaxy. Prerequisite: Astronomy 102 or 210; Physics 108. 3 hours or 1 unit.
322. **Stellar Systems, II.** Continuation of Astronomy 321. Galactic dynamics: stellar motions; galactic rotation; dynamics and mass distribution; stellar encounters; and dynamics of interstellar matter. Galaxies: distances; structural features; groups and clusters; radio galaxies and quasars; and spatial distribution and motions. Prerequisite: Astronomy 321. 3 hours or 1 unit.
357. **Radio Astronomy.** Same as Electrical Engineering 357. Instrumental theory and observational techniques; radar and meteors; the moon and planets; solar radio waves; and galactic and extragalactic radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit.
366. **Aeronomy: Physics of the Upper Atmosphere and Space.** Same as Electrical Engineering 366 and Physics 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmospheres; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; and experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.
401. **Stellar Atmospheres.** Physical characteristics of stellar atmospheres as derived from spectroscopic observations; radiation transfer; theory and observations of the continuous spectrum; limb darkening; formation of absorption lines; line profiles; curves of growth; relative chemical abundances; and emission features. Prerequisite: Consent of instructor. Desirable background includes some familiarity with atomic physics, advanced calculus, and general astronomy. 1 unit.

402. **Theoretical Astrophysics.** Same as Physics 402. Application of physical principles to selected topics in astrophysics, including stellar structure and evolution, neutron stars and pulsars, cosmic electrodynamics, and cosmological problems; emphasis on the physics involved rather than on detailed factual description. Prerequisite: Physics 342 or 386, or consent of instructor. 1 unit.
403. **Gaseous Nebulae and the Interstellar Medium.** Distribution, structure, and spectra of nebulae; physical processes in planetary and diffuse nebulae; recombination, fluorescence, and forbidden line radiation; determination of physical parameters; nature of the interstellar medium; interstellar gas and grains; and observation of interstellar medium. Prerequisite: Astronomy 301. 1 unit.
404. **Stellar Structure and Evolution.** Same as Physics 404. Relationship between observable features of stars and the physical processes that occur in their interiors; topics include matter and radiation in stars (equations of state, modes of energy flow, nuclear energy production, and element synthesis); structure of stars during all phases prior to the supernova or planetary nebula stage; stellar pulsations with reference to Cepheids and RR Lyrae variables; and properties of white dwarfs, neutron stars, and contact binaries. Prerequisite: Physics 360 and 382, or Astronomy 402 or Physics 402; or consent of instructor. 1 unit.
415. **Experimental Methods in Radio Astronomy.** Design and construction of instruments for radio astronomy; techniques of observation of celestial radio sources; and interpretation of data. Prerequisite: Consent of instructor. 1 unit. May be taken a second time for credit.
424. **Relativity and Cosmology.** Same as Mathematics 460 and Physics 424. Elements of tensor calculus and Riemannian geometry; special relativity; Lorentz transformations and equivalence of mass and energy; general relativity and the gravitational field of the sun; and galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit.
433. **Solar System Astrophysics.** Planetary orbits and perturbations; physical perturbations; physical parameters of the planets; planetary interiors, atmospheres, magnetospheres, and surface layers; the satellites; asteroids and comets; meteors, meteorites, and tekites; interplanetary grains and gas; and problems of origin and evolution. Prerequisite: Consent of instructor. 1 unit.
486. **The Constitution and Behavior of the Upper Atmosphere.** Same as Electrical Engineering 486. Chemical and dynamical processes in the upper atmosphere; emphasis on the processes by which emitted solar energy is transformed and the resulting behavior of the atmosphere and ionosphere. Prerequisite: Electrical Engineering 371 or consent of instructor. 1 unit.
491. **Seminar in Special Topics.** Prerequisite: Consent of instructor. 0 to 4 units.
499. **Thesis Research.** 0 to 4 units.

ATMOSPHERIC SCIENCES

Director of Laboratory: Professor Y. Ogura

Laboratory Office: 5-111 Coordinated Science Laboratory, Urbana

222. **Weather Processes.** Introduction to the mean state of the atmosphere, the fundamental physics of weather processes, and the mechanisms producing daily weather changes, both qualitative and quantitative in nature. Prerequisite: Mathematics 141. 3 hours.
301. **Introduction to Theoretical Meteorology.** Introduction to the basic physics and mathematics necessary to do research in meteorology. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
302. **Principles of Atmospheric Dynamics.** An introduction to those elements of fluid dynamics and thermodynamics essential to understanding the large- and small-scale mo-

tions of neutral atmosphere. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.

401. **Weather Analysis.** Describes the workings of the real atmosphere by giving the student practical experience in weather analysis, with emphasis on physical interpretation; also reviews the methods and procedures of weather analysis by numerical processes, in particular methods of deducing vertical motions. Prerequisite: Atmospheric Sciences 301 and 302. 1 unit.
405. **Simulation of Atmospheric Dynamics: Numerical Techniques.** Intended to give the student practical numerical techniques for solving those linear and nonlinear differential equations which appear frequently as initial and boundary value problems in hydrodynamics and dynamic meteorology. Prerequisite: Mathematics 287 and 343, or consent of instructor. 1 unit.
406. **Simulation of Atmospheric Dynamics: Physical Aspects.** Intended to describe the principles and methods of simulating and predicting large-scale atmospheric motions on the basis of hydrodynamics and thermodynamics. Prerequisite: Atmospheric Sciences 302. 1 unit.
490. **Individual Study.** Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
491. **Seminar in Atmospheric Sciences.** Seminar on topics of current interest; subjects announced in the Timetable. Prerequisite: Consent of instructor. 0 to 1 unit.
497. **Special Topics in Atmospheric Sciences.** Lecture course in topics of current interest; subjects such as the general circulation, physical meteorology, upper atmosphere dynamics, atmospheric convection, atmospheric turbulence and boundary layers, dynamic oceanography, and advanced topics in atmospheric dynamics will be covered in semester offerings on a regular basis. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Section A, for master's degree candidates; Section B, for doctoral degree candidates. Prerequisite: Consent of instructor. 0 to 4 units.

AVIATION

Director of Institute: R. E. Flexman

Institute Office: Terminal Building, University of Illinois — Willard Airport, Savoy 61874

101. **Private Pilot.** Prepares the beginning flight student for an FAA Private Pilot certificate; emphasis on airplane utility and safety. Forty-eight classroom hours of ground school instruction on federal aviation regulations, air navigation, radio communications, weather, general operation of airplanes, and safety practices; thirteen hours of flight discussion; eleven hours of flight simulator training; and thirty-one hours of flight training in various makes of airplanes. 3 hours.
102. **Orientation Refresher.** An intermediate course to gain additional aeronautical proficiency in the primary trainer and serve as an introduction to other types of aircraft; emphasis on airplane utility and safety; eighteen hours of flight, four hours of flight simulator training, and five hours of flight discussion directed to airplane operation. Prerequisite: Credit or concurrent registration in Aviation 101, or consent of director. 0 credit.
105. **Soaring, I.** Basic soaring for those with no previous flight experience; an aviation recreational course covering regulations, navigation, meteorology, aerodynamics, launching, and flight maneuvers required for glider operation; includes approximately twenty dual flights, five solo flights, and eight hours of ground discussion. 1 hour.
115. **Soaring, II.** Intermediate soaring for those with any power flight certificate or previous soaring experience equivalent to Aviation 105; offers additional experience and knowledge preparatory to glider pilot certification; includes approximately ten dual flights,

fifteen solo flights, and eight hours of ground discussion. Prerequisite: Aviation 105 or equivalent. 1 hour.

120. **Secondary Flight.** The second phase of flight training in preparation for an FAA Commercial Pilot certificate; develops further the qualities of a good pilot, broadens experience, and introduces advanced maneuvers; forty-eight classroom hours of ground school instruction in meteorology and aircraft engines, and forty-four hours of flight training (sixteen dual and twenty-eight solo) in two-place and four-place airplanes. Prerequisite: Aviation 101 or private pilot certificate; consent of director. 3 hours.
130. **Intermediate Flight.** The third phase of flight training in preparation for an FAA Commercial Pilot certificate; emphasis on cross-country, night, and instrument flying; includes forty-eight classroom hours of ground school instruction in cross-country planning and in-flight procedures, including navigation and radio communications, and forty-three hours of training (seventeen dual, twenty-one solo, and five flight simulator) in two-place side-by-side radio-equipped aircraft. This course may be taken by private pilots who wish to increase their cross-country and night-flying proficiency. Prerequisite: Aviation 101 or private pilot certificate; consent of director. 3 hours.
140. **Advanced Flight.** The final phase of flight training in preparation for an FAA Commercial Pilot certificate; emphasis on precision flying. Forty-eight classroom hours of ground school instruction including general operation of airplanes and a review of federal aviation regulations, navigation, radio communications, meteorology, and aircraft engines in preparation for a commercial pilot certificate, and forty-four hours of flight training (fourteen dual and thirty solo) in two-place tandem monoplanes or four-place monoplanes. Prerequisite: Aviation 120 and 130; consent of director. 3 hours.
142. **Powerplant Theory.** A study of reciprocating and turbine internal combustion aircraft engines; includes history and development of powered flight, advances in thermodynamics and metallurgy, and improvements in volumetric and mechanical efficiencies; and also a study of supporting systems and design variations for all types of aircraft engines in use. 4 hours.
143. **Aircraft Materials and Processes, I.** Theory and practice in the techniques of precision measurement safetying and nondestructive inspection; identification and use of materials suitable for aircraft construction. 2 hours.
144. **Powerplant Theory Laboratory.** An application of the principles of construction and theory of operation and airworthiness criteria as introduced in Aviation 142; includes maintenance procedures and engine operation for both piston and turbine powerplants. Prerequisite: Credit or concurrent registration in Aviation 142. 2 hours.
145. **Aircraft Physics.** A study of the basic physical principles that apply to present-day aerospace vehicles; includes AC and DC theory, power sources, transmission, measurement, solid state devices, and troubleshooting problems existing in aircraft electrical circuits. 3 hours.
147. **Introduction to Federal Aviation Regulations.** A study of regulations, directives, and specifications governing the manufacture, operation, and maintenance of aircraft and the control of air traffic as well as the qualifications and certification of personnel and equipment engaged in aircraft operation and maintenance. 3 hours.
152. **Powerplant Systems, I.** Theory and operating principles of the ignition, starting, and electrical power generating components and systems used with aircraft turbine and reciprocating powerplants. Prerequisite: Aviation 142 and 145. 4 hours.
153. **Aircraft Materials and Processes, II.** A survey of materials used in the manufacture of structural components of aerospace vehicles; emphasis on the sources, manufacturing processes, physical properties, and working characteristics of various ferrous and non-ferrous metals. 2 hours.
154. **Powerplant Systems, II.** Theory of operation, design, and maintenance procedures for fixed pitch and controllable propellers; includes a study of propeller governing and control systems for reciprocating and turboprop engines. Prerequisite: Aviation 145. 3 hours.

155. **Aircraft Mathematics.** Arithmetic fundamentals and their application to the field of aviation mechanics; includes wing rib layout, bend allowance, load factors, weight and balance, engine thrust and horsepower, and fuel and oil consumption problems. 3 hours.
156. **Powerplant Systems, III.** An introduction to fuels and fuel systems as related to aircraft turbine and reciprocating powerplants; study of fuel system functions including carburetion, fuel injection, fuel management, and supercharging. Prerequisite: Aviation 142 and 145. 3 hours.
157. **Powerplant Conditioning and Testing.** A study of powerplant malfunction, diagnosis and maintenance procedures, materials, and equipment; includes condition monitoring techniques and some of the economic aspects of powerplant maintenance. Prerequisite: Aviation 152 and 156. 7 hours.
159. **Powerplant Inspection and Regulations.** A study of federal aviation regulations, advisory circulars, airworthiness directives, and manufacturers' publications as they apply to aircraft powerplants; includes a survey of specialized inspection techniques and equipment for both destructive and nondestructive inspection procedures. 3 hours.
163. **Aircraft Materials and Processes, III.** A survey of nonstructural materials used in the construction of aircraft components; the sources, manufacturing processes, physical properties, and working characteristics of synthetics, fabrics, composites, woods, and their associated surface treatments studied in detail. 3 hours.
165. **Aircraft Fabricating Processes, I.** Procedures and techniques of mechanical, nonfusion attachment; sheet metal forming; and use of adhesives, bonded materials, and plastics in aircraft component fabrication. Laboratory experiences include the use of mechanical fasteners, similar and dissimilar metal assembly, and plastic and bonded structure fabrication. Prerequisite: Aviation 143, 153, and 155. 4 hours.
167. **Aircraft Fabricating Processes, II.** Fusion and adhesion procedures and techniques including gas, AC and DC arc, and inert gas processes. Laboratory experiences include fusion and adhesion processes with representative metals used in the aircraft industry. Prerequisite: Aviation 143 and 153; General Engineering 105. 2 hours.
169. **Aircraft Systems, I.** A study of basic principles and design concepts of the environmental and life support systems used in modern aircraft; study of representative systems for pressurization, oxygen, heating, cooling, and ice and fire protection with detailed emphasis on individual components and their relationship to the complete system. Prerequisite: Aviation 145. 4 hours.
170. **Aircraft Systems, II.** Electrical distribution circuits and associated lighting, power, communication, navigation, and instrumentation systems common to modern aircraft; emphasis on circuit analysis and performance testing. Prerequisite: Aviation 145, 152, and 155. 5 hours.
172. **Aircraft Systems, III.** Includes hydraulic and pneumatic power systems as utilized in modern aircraft; emphasis on theory of operation, design concepts, component relationships, and malfunction diagnosis. Prerequisite: Aviation 145. 3 hours.
174. **Aircraft Assembly and Inspection.** Aircraft assembly, configuration, and alignment consistent with associated aerodynamics theory; study of structure and systems inspection and FAA regulations related to the achievement of maximum safety of aircraft. Prerequisite: Aviation 163, 165, 167, 170, and 172. 5 hours.
181. **Introduction to Electronic Theory and Practices.** DC and AC circuitry; series, parallel, and combination circuits; Ohm's and Kirchhoff's laws; conductors, insulators, and circuit-controlling devices; and laboratory experience in the use and care of tools in the fabrication of subassemblies and simple circuits. 3 hours.
182. **Basic Electronic Theory.** Characteristics of alternating current; time-varying circuits; analyzing behavior of alternating current components; phase and power factor; power measurement; integrating circuits; differentiating circuits and other miscellaneous alternating circuits; and principles of vacuum tubes and transistors. Prerequisite: Aviation 181. 3 hours.

183. **Advanced Electronic Theory.** Timed circuits and circuits for power supplies, detectors, amplifiers, and oscillators; ultrahigh frequencies and microwaves; principles of radar and microwave systems; time-constant and pulse-forming circuits; and locking, switching, and sweep circuits. Prerequisite: Aviation 182. 3 hours.
184. **Aircraft Navigation and Communications Systems.** Very high and ultrahigh frequency receiving and transmitting equipment; instrument landing systems; and navigation systems including direction finding, distance measuring, and surveillance radar. Prerequisite: Aviation 183 or consent of instructor. 5 hours.
186. **FAA and FCC Regulations.** A study of the publications and regulations of the Federal Aviation Administration and the Federal Communications Commission including the design, construction, installation, servicing, repair, and operation of ground and airborne electrical and electronic equipment. 3 hours.
200. **Basic Instrument Flight Techniques.** First course in preparing the commercial pilot for an FAA instrument rating. Forty-eight classroom hours of ground school instruction in theory of instrument flight, airplane instruments and instrument systems, navigation, meteorology, and federal aviation regulations; twenty to twenty-two hours of simulated instrument flight; and ten to twelve hours of instrument flight simulator training. Prerequisite: Commercial pilot certificate or equivalent flight experience; junior standing; consent of director. 3 hours.
210. **Advanced Instrument Flight Procedures.** Second and final course leading to an FAA instrument rating. Forty-eight classroom hours of ground school instruction in preflight planning and in-flight procedures including use of instrument flight publications, navigation, meteorology, and air traffic control procedures; twenty to twenty-five hours of simulated instrument flight; and ten to twelve hours of instrument flight simulator training. Prerequisite: Aviation 200 or forty hours of simulated instrument flight experience; junior standing; consent of director. 3 hours.
220. **Flight Instructor.** Prepares the commercial pilot for an FAA Flight Instructor certificate. Forty-eight classroom hours of ground school instruction on techniques of flight instruction and theory of flight, and a minimum of twenty-five hours of flight training in four-place aircraft. Prerequisite: Commercial pilot certificate; junior standing; consent of director. 3 hours.
222. **Instrument Flight Instructor Course.** Leads to an instrument instructor's rating on the student's flight instructor certificate; five hours of simulator, ten hours of flight, and one hour of flight check time. Includes refresher on chart symbol interpretation, federal aviation regulations, communications, instrument construction and operation, and electronic aids to navigation; designed to include obtaining a flight instructor instrument rating. Prerequisite: Commercial pilot certificate; instrument rating; flight instructor certificate; airplane rating; consent of director. 1 hour.
224. **All Attitude Orientation.** Safe handling of an aircraft in all attitudes through various aerobatic maneuvers which include loops, snap rolls, slow rolls, Immelmann, Cuban 8's, and similar type maneuvers; thorough check of takeoff and landing procedures. Prerequisite: Aviation 101 or the private pilot certificate. 1 hour.
250. **Practice Teaching, Airplane.** Practice teaching using classroom, audiovisual material, simulator, and airplane; prepares the certified flight instructor to teach in all modes of aviation education. A minimum of two hours of classroom lecture, twenty hours of simulator instruction, and six hours of airplane instruction is given by the student; an additional twenty hours of classroom lecture clarifies and explains the proper method of successful instruction. Prerequisite: Aviation 220 or flight instructor certificate; junior standing; consent of director. 3 hours.
260. **Aerospace History.** Surveys civilian and military developments since 1900, emphasizing U.S. civil aviation and astronautics; includes technological trends with stress on political, economic, and social implications, both domestic and international. 3 hours.
280. **Special Rating (Multiengine Land).** Prepares the commercial pilot for an FAA multiengine land airplane rating; sixteen hours of ground school instruction and nine hours

of flight training in a multiengine land airplane. Prerequisite: Commercial pilot certificate; consent of director. 1 hour.

- 291. Special Ratings and/or Specialized Flight.** Prepares the commercial pilot for special FAA pilot certificates and/or ratings such as seaplane, airline transport pilot, and helicopter, and specialized flight such as advanced multiengine operation; sixteen hours of preflight (ground school) instruction and variable flight instruction as selected by the student. Options are advanced multiengine, helicopter, and airline transport pilot. Registration is limited to professional students with approval of director through chief flight instructor. Prerequisite: Commercial pilot certificate; consent of director. 1 hour.

BANDS

Director: Professor H. Begian

Office: 140 Band Building, Champaign

All band courses are open to men and women students who have been accepted by examination, with assignments being made according to proficiency and instrumentation. Completion of each course involves, in addition to the regular schedule of rehearsals, participation in the public appearances of the bands.

- 101. Symphonic Band — Large.** Maintains a complete symphonic band instrumentation for the study and performance of all types of band literature. 1 hour.
- 102. Symphonic Band — Small.** Maintains a complete small symphonic band instrumentation for the study and performance of band literature intended for the smaller instrumentation. 1 hour.
- 103. First Concert Band.** Maintains the instrumentation of the standard band and serves as a training organization for the symphonic bands. The literature studied and performed is of the highest calibre and technical difficulty. 1 hour.
- 104. Second Concert Band — A.** Enrolls those who do not at first qualify for positions in the other bands until they become eligible for promotion as improvement is shown and as vacancies occur. The band literature studied is of high quality but technically is less difficult than the music for the top three bands. 1 hour.
- 105. Second Concert Band — B.** Enrolls those who do not at first qualify for positions in the other bands until they become eligible for promotion as improvement is shown and as vacancies occur. The band literature studied is of high quality but technically is less difficult than the music for the top three bands. 1 hour.
- 106. Marching Band.** The Marching Band prepares and performs at least six shows per football season; music used is of the best quality available for this type of service activity. 1 hour.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.

BASIC MEDICAL SCIENCES

(See Medical Sciences)

BIOCHEMISTRY

(See Chemical Sciences)

BIOLOGY

(See Life Sciences)

BIOPHYSICS

(See Life Sciences)

BOTANY

(See Life Sciences)

BUSINESS

Dean of College: Dean V. K. Zimmerman

College Office: 260 Commerce Building (West), Urbana

299. **International Business Study in Absentia.** Upon prior written approval of his adviser, his major department, and the College of Commerce and Business Administration office, a student may earn up to 18 credit hours per semester undertaking a study and/or research project in international business away from the Urbana-Champaign campus. The student's major department verifies the satisfactory progress of the work by means of interim and final written reports, written or oral examinations, or other means established by the department. While absent from the Urbana-Champaign campus, the student must continue to pay all fees required by the University of Illinois to retain continuity of enrollment and to allow the time spent away from this campus to count toward residency. Prerequisite: The student must be a commerce major in good standing who has completed at least 45 semester hours toward a bachelor's degree with at least one semester in residence at the University of Illinois. 0 to 18 hours. This course may be repeated for a maximum of 36 credit hours, all of which must be earned within twelve consecutive months.

BUSINESS ADMINISTRATION

Head of Department: Professor K. P. Uhl

Department Office: 350 Commerce Building (West), Urbana

190. **Motivation and Responsibility in Business.** A seminar directed to an investigation of goals, restraints, and responsibilities in American business. Open only to freshman par-

ticipants in the program for honors students in a department or college of the University. Prerequisite: Participation in an honors program. 3 hours.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **The Legal Environment of Business.** Examination of the nature of law and the formation and application of legal principles; the role of law in society; the legal environment in which business operates, particularly government taxation; the regulation of commerce, competition, and labor-management relations; and the concept of property: its creation, transfer, and importance to our business society. Prerequisite: Junior standing. 3 hours.
202. **Principles of Marketing.** Emphasis on the marketing concepts of planning, organization, control, and decision making from the viewpoint of the business executive. Credit is not given for both Business Administration 202 and 272. Prerequisite: Economics 172 or equivalent. 3 hours.
203. **Principles of Business Law.** Contracts, the uniform commercial code, creditors' rights, agency and employment, business organizations, and property. Prerequisite: Business Administration 200. 4 hours.
206. **Marketing Environment.** Attention is given to the relationship of firm to firm, to government, to labor, and to other organized groups or institutions as they interact with the marketing function of the firm; emphasis on the importance of marketing operations on cultural, political, and social forces, and how these forces affect the alternatives considered and the decision methods used by marketing management. Prerequisite: Business Administration 202. 3 hours.
210. **Management and Organizational Behavior.** A general analysis of management and organizational behavior from a systems point of view, including classical organizational theory and management, organizational behavior, and management science; environmental forces; planning, organizing, and control processes; motivation, incentives, leadership, communication, and interpersonal relations; and discussion of production and decision-making and mathematical models. Credit is not given for both Business Administration 210 and 247. Prerequisite: Junior standing. Students are encouraged to take Business Administration 210, 202, and Finance 254 concurrently. 3 hours.
212. **Retail Management.** Fundamentals of buying, sales promotion, pricing, control, and store finance. Prerequisite: Business Administration 202. 3 hours.
247. **Introduction to Management.** Summary of management in a modern industrial enterprise; emphasis on motivation, small group behavior, and the problems of designing and operating a formal organization structure. For noncommerce students only. Credit is not given for both Business Administration 247 and 210. Prerequisite: Sophomore standing. 3 hours.
249. **Human Relations.** Interrelationships of individuals and groups within the work environment of an industrial organization; motivation and communication for work and cooperation between managers and different economic and social groups; and qualifications and practices of the successful manager. Open to noncommerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.
261. **Summary of Business Law.** Basic principles of the private law of business including the law of contracts, agency, and business organizations; a brief introduction to the law of sales, commercial paper, security devices, and property. Open only to noncommerce students; credit is not given for both Business Administration 261 and 201. Prerequisite: Junior standing. 3 hours.
272. **Industrial Selling.** A survey course in marketing and salesmanship for noncommerce students interested in selling industrial products. Credit is not given for both Business Administration 272 and 202. 3 hours.
290. **Human Values and Business Behavior.** Designed to compel tomorrow's business leaders to develop reasoned viewpoints on critical issues and to sharpen their analytical skills in evaluating a variety of viewpoints on a diversity of topics; aims to contribute to more effective business leadership and community citizenship. Open to advanced un-

dergraduate honors students in the University. Prerequisite: Advanced standing; James Scholar or participant in a departmental honors program. 3 hours.

294. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
314. **Production.** Introduction to production management, consideration of major problems of the production area, and the use of quantitative methods for solving them. Prerequisite: Business Administration 374 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
315. **Management in Manufacturing.** The application of production concepts and quantitative techniques to actual industrial problems; the mathematical structure of the particular production problems; the general structure of the production system and its interaction with marketing and budgeting; and areas including inventory control, production processes, programming, production control, forecasting of production levels, simulation of the production system, and physical planning of industrial plants. Prerequisite: Business Administration 314. 3 hours or $\frac{1}{2}$ unit.
320. **Marketing Research.** Investigation of the development and applicability of information systems techniques to marketing problems; analysis of the marketing management process; exploration of the underlying concepts related to the information needed to serve the process; and the demonstration of incorporation of information resources into the management function. Covers the use of behavioral sciences, research methods, social processes, and structure influences upon marketing activities, demographic variables, application of Bayesian decision theory, studies of promotional activity, simulation and programming models, planning models, and strategy formulation models which provide an analytical structure for the solution of marketing problems. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.
321. **Organizational Behavior.** Same as Labor and Industrial Relations 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environment; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210, Psychology 100 and 201, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
323. **Industrial Social Systems, II.** Understanding of complex organizations; particular attention to ways of dividing work, achieving coordination, and issues connected with change and adaptation. Prerequisite: Business Administration 321; Psychology 201. 3 hours, or $\frac{1}{2}$ to 1 unit.
337. **Promotion Management.** Designed to enable the student, through directed and supervised investigation of selected psychological, economic, and sociological problems, to become acquainted with the methods of demand analysis and its application to the interrelationships of marketing management, advertising management, and sales management; discussion of communication theory as it relates to the goals and means of winning patronage for the firm; and emphasis on the effect or control of the communication process. Class discussion focuses upon literature in demand stimulation and communications and the testing of relevant hypotheses. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.
344. **Consumer Market Behavior.** Analysis of consumer motivation, buying behavior, market adjustment, and product innovation, including a survey of explanatory theories of consumer market behavior and produced reactions; behavioral aspects of the marketing process from the producer to ultimate user, or consumer; fundamentals of product planning, development, engineering, and promotion viewed as part of the total marketing program; consideration of normative models of the decision-making process for

winning patronage in intermediate, industrial, and consumer markets; and the decision-making process by consumers evaluated with reference to psychological drives used by producers, middlemen, and consumers. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.

351. **Personnel Administration.** Study of concepts and methods used by the staff personnel unit in building and maintaining an effective work force in an industrial organization; development of ability to design the personnel subsystem within the firm and to deal effectively with problems encountered in such areas as recruitment, selection, training, and wage and salary administration; and considerable emphasis on case analysis, role playing, and research. Credit is not given for Business Administration 351 and Psychology 245 and Industrial Administration 448 or 449. Prerequisite: Business Administration 323; Economics 173 and 240. 3 hours, or $\frac{1}{2}$ to 1 unit.
352. **Pricing Policies.** The essential nature of marketing decisions and pricing, marketing, organization and the pricing process, price theories, and pricing models; contributions of operations research and behavioral sciences to pricing analysis; and the relationship of pricing objectives, methods, strategies, and policies to market behavior and the goals of the firm. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.
360. **Business Logistics.** The ecology, analysis, and development of integrated distribution systems; the application of quantitative tools, economic analysis, transportation and marketing management in the analysis, and interpretation and design of the physical flow of goods through marketing network alternatives; attention to the theory of market structures, transport networks, location, and cost control; and consideration of site selection, warehousing, inventory management, logistic communications networks, and data control models. Prerequisite: Business Administration 202 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
370. **International Marketing.** The role of enterprise, comparative marketing and transport institutions and systems, and comparative marketing organizations and systems of administration in selected foreign countries and the United States; the managerial and operational problems of world enterprise with emphasis on the role of ethnic and cultural differences in influencing marketing strategy. Prerequisite: Business Administration 202 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
373. **Business Information Systems.** Fundamentals of business data processing; consideration of the use of modern electronic computers in the areas of accountancy, economics, management, marketing, and general business. The facilities of the Digital Computer Laboratory are utilized. Prerequisite: Accountancy 166 or 108; Economics 170. 3 hours, or $\frac{1}{2}$ or 1 unit.
374. **Operations Research.** Introduction to methods of operations research from an executive or managerial viewpoint, emphasizing formulation of business problems in quantitative terms; industrial applications of linear programming, dynamic programming, game theory, probability theory, queueing theory, and inventory theory. Prerequisite: Business Administration 210 and Economics 173, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
375. **National Income and Business Forecasting.** Same as Economics 375. The significance of national income and related economic accounts for analysis and forecasting of business conditions; develops the interrelations between data systems used by government agencies and business concerns in program planning and current decision making; and introduces the use of models for solving problems in this area. Prerequisite: Economics 103 or 108; Economics 171 (for business majors, Business Administration 321 and 374). 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Management Science in Marketing.** The appraisal and diagnosis, organization and planning, action and control of commodity and product-service distribution, marketing analysis and systems, and demand stimulation; survey of normative models for decision making in a variety of marketing situations and systems; introduction to the behavioral theory of the firm and its application to different marketing targets, institutional settings, or market arrangements; discussion of the various analytical tools available to

firms for appraising, diagnosing, organizing, planning, and formulating market strategies; and emphasis on principles of behavioral sciences and quantitative techniques. A terminal course that integrates the analysis of a wide range of marketing problems and situations. Prerequisite: Business Administration 320 and 337. 3 hours or ½ unit.

389. **Business Policy.** Analysis of policy formulation and implementation from a company-wide standpoint; emphasis on integration of knowledge and approaches across functional areas; both endogeneous and exogeneous factors which affect company policies; and the role of the firm in society. Prerequisite: Business Administration 321 or 344; Business Administration 374; senior standing. 3 hours or ½ unit.
401. **Scientific Management, I.** Same as Industrial Engineering 401. Study of modern management principles on the basis of quantitative methods, concentrating on such operations research techniques as nonlinear and dynamic programming and queueing theory. Prerequisite: Industrial Engineering 386 and Mathematics 361, or consent of instructor. 1 unit.
402. **Scientific Management, II.** Same as Industrial Engineering 402. A systems approach to industrial problems involving inventory control, scheduling and line balancing, and maintenance and investment theory; application of formally accumulated knowledge of operations research techniques. Problems from industry are assigned to small teams of students. Prerequisite: Business Administration 401; background in computer technology or consent of instructor. 1 to 1 ½ units.
405. **Marketing Theory and Systems.** A detailed study of macro- and micro-marketing systems and the various approaches to marketing theory; attention given to general systems theory, the nature of marketing systems, system adaptation to the environment, concepts of theory, and major approaches to macro- and micro-theory in marketing. 1 unit.
406. **Development of Marketing Thought.** Emphasis on an analysis of marketing thought from the late 1800s to the present; attention directed primarily to general marketing and marketing management, yet consideration given to major contributions in selected areas of marketing; and evaluation of the literature and scholars selected both as reflections of their times and as contributions or contributors to contemporary thought. Prerequisite: Business Administration 405. 1 unit.
407. **Comparative Marketing Systems.** Examination of comparative marketing systems; topics include specification and identification of structural elements of systems, analysis of static and dynamic properties, methods of analyzing systems such as input-output and flow analysis, the role of marketing in comparative economic systems, and the role of marketing in developing economies. Prerequisite: Business Administration 405. 1 unit.
408. **Foundations of Behavioral Science for Administration.** Develops and integrates fundamental behavioral concepts and theory having administrative applications; initially focuses on the individual decision maker and ultimately includes interpersonal, organizational, and social structures and influences; and develops strategies and methods of research on behavioral applications in business. Credit is not given for both Business Administration 408 and 510. 1 unit.
410. **Organizational Sciences, I.** Same as Political Science 460, Psychology 453, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; in addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or consent of instructor. 1 unit.
411. **Organizational Sciences, II.** Same as Political Science 461, Psychology 454, and Sociology 457. Introduction to the principal theories and important empirical research in various disciplines that study organizations; in addition to examination of the subject matter of various disciplines, students critically examine the capacities and limitations

of the various fields to make contributions to the study of organizations. Prerequisite: Business Administration 410. 1 unit.

415. **Foundations of Consumer Behavior.** Study of basic factors influencing consumer behavior; attention to psychological, sociological, and economic variables, including motivation, learning, attitude, personality, small groups, social class, demographic factors, and culture, in order to analyze their effects on purchasing behavior. 1 unit.
416. **Consumer Information Processing.** Analysis of information flows between buyer and seller; informational properties of demand stimulation strategies considered from the viewpoints of the firm, the consumer, and society; and consumer decision making examined by drawing upon the psychology and sociology of buyer motivation and social influence. Prerequisite: Business Administration 415. 1 unit.
421. **Marketing Strategy: Theoretical Foundations.** A formal analysis of strategy drawing on concepts from the theory of games, decision theory, value theory, and information theory; topics cover elements of game models, classes of decision problems, games against nature, modern utility theory, information theory, group decision making, statistical decision theory, and linear and nonlinear optimization. 1 unit.
422. **Marketing Strategy: Decision Models.** The role of models in the design, implementation, and adjustment of seller strategy; application of simulation, programming, and other methods to the specification and solution of product, price, promotion, and other marketing problems; and topics including the nature of models and model building, forecasting models, optimization models, and other decision models. Prerequisite: Business Administration 421. 1 unit.
445. **Systems Modeling and Simulation.** Same as Computer Science 445. Theory and techniques of simulation and gaming; simulation languages such as GPSS, DYNAMO, and SIMSCRIPT. Applications: investigation, control, and design of various systems (inventory, production scheduling, computer, marketing, and others). Prerequisite: Computer Science 105 or Mathematics 363 or Business Administration 374, or equivalent, or consent of instructor. 1 unit.
448. **Problems of Personnel Management.** Same as Labor and Industrial Relations 448. Examination of the organization and administration of the personnel function in management; the relations of personnel administration to operating departments and the scope of business and industrial personnel services; analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, carried out through case studies and direct industrial contracts; and specific consideration given to problems up to and including placing the person on a job. Prerequisite: Business Administration 248 or equivalent; consent of instructor. 1 unit.
471. **Survey Methods in Marketing Research.** Same as Sociology 474. Analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Economics 171 or equivalent. 1 unit.
472. **Multivariate Methods in Marketing.** The use of multivariate statistical methods in marketing research; topics covered include multiple regression and correlation, analysis of variance and covariance, canonical correlation, discriminant analysis, factor analysis, and simultaneous methods such as two-stage least squares and limited information one-maximum likelihood. Prerequisite: Economics 470. 1 unit.
473. **Experimental Design.** Training in the design, execution, and interpretation of field and laboratory experimental research; emphasis on the evaluation of alternative designs, execution of problems, and interpretation of data; and a review of illustrative research studies made, an actual study designed, and data collected and interpreted. 1 unit.
474. **Operations Research.** Study of quantitative techniques useful in economic analysis and decision making; mathematical programming, dynamic programming, queueing theory, renewal theory, and simulation methods applied to economic control systems with special emphasis on the problems of the firm. Offered in 1975-76 and in alternate

years. Prerequisite: Mathematics 363 and Business Administration 374, or equivalent. 1 unit.

485. **The Sampling of Human Population and Social Organizations.** Same as Sociology 485 and Psychology 485. Procedures for selecting samples from and estimating population parameters for human populations and social organizations; types of sample designs treated include simple random samples, stratified, and cluster samples together with random number and systematic selection techniques; and emphasis given to the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.
490. **Seminar in Business Administration.** Special topics in the general area of business. Topics are selected by the instructor at the beginning of each semester. 1 unit.
491. **Seminar in Special Topics.** Lectures in topics of current interest not covered by regular course offerings. Subjects are announced in the Timetable. Prerequisite: Consent of instructor or head of department. $\frac{1}{4}$ to 1 unit.
493. **Research in Special Fields.** $\frac{1}{4}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.
500. **Economic Analysis of the Firm.** Introduces the student with little or no background in economics to basic principles of analyzing the industrial structure and developing the marketing, financial, and general operating strategies of the firm in a dynamic economic system. Graduate credit is not given for Business Administration 500 and Economics 300 or 400. 1 unit.
501. **The Economic Environment.** Analysis of the functioning of the economy from an aggregative point of view; role of government policy in affecting the economic environment. Graduate credit is not given for Business Administration 501 and Economics 301 or 401. 1 unit.
511. **Organizational Behavior.** Examination and analysis of the organization as a social system and the impact of its various components on work attitudes and behavior; topics include the development of organizational structures, organizational effectiveness, decision making and policy formulation, leadership, and change. Prerequisite: Business Administration 408. 1 unit.
512. **Business Organization and Its Environment.** Analysis of business organizations adapting to shifts in internal and external elements; major emphasis on (1) the business firm as a part of a complex socioeconomic system; (2) the effects of government, labor unions, and political, religious, and business organizations on the executive's decision problems; (3) environmental factors conducive to organizational change; and (4) organizational growth. Prerequisite: Business Administration 511. 1 unit.
513. **Seminar in Organization Theory.** Examination of the major types of organization theory; use of organization theory to guide research and to make business decisions; and examination of major research methods used to study business organizations. Prerequisite: Business Administration 512. 1 unit.
520. **Marketing.** An introductory analysis of the marketing system, its operations, and the mechanisms for coordinating these operations; study of relationships of the firm to other firms and other institutions in the marketing system; analysis of the effects of such relationships on the nature of decision problems of the individual business; and discussion of the firm's problems in developing an integrated marketing program, and the specific problem areas of price, channel, location, sales, and market development. 1 unit.
522. **Quantitative Analysis for Marketing Decisions.** Development of analytic quantitative models of various aspects of the firm's marketing environment and of models of marketing decision problems; study of the ways in which such models can be used as a basis for making marketing decisions; and topics including market measurement, estimation of various kinds of market data, and identification of the relationships between marketing

variables and forecasting. Prerequisite: Business Administration 520 or equivalent. 1 unit.

- 524. Market Segmentation.** Consideration of unique subsets of a group of potential customers and industrial buyers that may differ in accessibility of behavior from the aggregate market; an historical perspective of market segmentation, alternative bases of segmentation, the role and methods of market segmentation research, and the application of segmentation to marketing decision making. Prerequisite: Business Administration 520 or consent of instructor. 1 unit.
- 525. Product Management.** The decisions on the firm's total market offer, including such topics as use of market analysis in making decisions on assortment, product development, pricing, packaging, branding, and sales forecasting; coordination of these decisions and actions with market communications, physical movement, production, finance, and the overall goals and policies of the firm; and emphasis on the use of analytic and research methods in making assortment and product decisions. Prerequisite: Business Administration 522 or equivalent. 1 unit.
- 531. Production Management.** An introductory course in decision-making problems in production; includes the theoretical foundations for production management as well as the applications of decision-making techniques to production problems in the firm; and considers production processes, plant layout, maintenance, scheduling, quality control, and production control in particular. 1 unit.
- 532. Production Planning and Control.** In-depth treatment of decision-making topics in production at the factory manager level and above; topics include the development of generalized decision rules and systems analysis in production; and particular emphasis on the design of production control, quality control, and inventory control systems, and how each of these systems is integrated into the firm as a whole. Prerequisite: First year of the M.B.A. program. 1 unit.
- 533. Quantitative Techniques in Production.** An advanced course in the application of quantitative techniques to decision-making problems dealing with production in the firm; topics include structural estimation of production systems, application of operations research techniques to production problems, and computer simulation of decision systems. Prerequisite: Business Administration 532 or equivalent. 1 unit.
- 540. Written Analysis.** Develops the student's ability in writing reports based upon analysis of cases and the conclusions reached; a threefold objective: (1) to improve the student's capacity to express himself effectively and efficiently in writing; (2) to contribute to the sharpening of his analytic skills; and (3) to help him integrate the knowledge learned in the functional fields. Prerequisite: Enrollment in a graduate program. ½ unit.
- 542. Business and Society.** The position of the business enterprise as an institution in American society; the role of the businessman in that society. Prerequisite: Completion of the first year of the M.B.A. program or equivalent. 1 unit.
- 543. The Law and Business Policy.** The legal environment in which business decisions are made, including the legal system and the role of courts, government taxation and regulation of business, administrative law, antitrust law, labor law, and trends in the law affecting business policy. 1 unit.
- 544. Business Policy and Planning.** Policy construction and planning of policy implementation at the executive level; case studies of company-wide situations from the management point of view; and integration and application of material from previous courses. Credit is not given for both Business Administration 544 and 389. Prerequisite: Business Administration 408, 520, 531 and 551, or equivalent. 1 unit.
- 551. Financial Management.** An introduction to financial decision making in the firm; development of a decision-making framework for determining the most efficient allocation of resources within the firm; and emphasis placed on the analysis of capital investment projects, long-term sources of funds, and short-term financing problems. 1 unit.
- 552. Analysis of Financial Systems.** Same as Finance 452. An integration of the investment, long-run financing, and short-run investment-financing decision processes; simulation models and/or other techniques used to study each decision process and to introduce

the dimensions of uncertainty, dynamism, and multivariables. Prerequisite: Finance 243 or Business Administration 551, or equivalent; Economics 470 or Business Administration 572, or concurrent registration in either course. 1 unit.

553. **Advanced Analysis and Theory.** Same as Finance 453. Special emphasis on research and model building of the financial decision system; analysis of financial decision systems examined by using various techniques, e.g., Markov process, decision theory, statistical models, linear and/or dynamic programming, risk analysis, and forecasting models. Prerequisite: Business Administration 552 or equivalent. 1 unit.
555. **Risk Management and Control.** Same as Finance 470. Analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses; techniques for risk and loss control; models for risk management decision making; and procedures for administering risk management policy relating to nonspeculative (insurable) risk. Prerequisite: Business Administration 552 and 560, or equivalent, or consent of instructor. 1 unit.
557. **Security Analysis and Investment Management.** Same as Finance 457. Application of decision theory and quantitative methods to problems of individual security valuation and selection, portfolio composition, and investment management. Prerequisite: Finance 254 or equivalent, or Business Administration 551 or equivalent. 1 unit.
558. **Portfolio Theory.** Same as Finance 458. A theoretical and research-oriented course related to the problems of efficient allocations of resources in security portfolios of large financial institutions; integration of interdisciplinary problems such as capital market price behavior and stock price behavior with portfolio analysis models. Prerequisite: Finance 457 or Business Administration 557, or equivalent. 1 unit.
560. **Managerial Accounting and Control.** Analysis of managerial controls, the information needed for their operation, and the manner in which accounting provides that information; emphasis on accounting as a tool of management; and problems and cases stressing the type of figure information relevant to managerial decisions and the methods of using such data. 1 unit.
562. **Industrial Cost Control.** Study of cost accounting with emphasis on the use of operating data by management for control purposes; methods of material pricing and labor costs including fringe benefits; indirect manufacturing costs, direct costing, and standard costs; estimated and statistical costs; distribution costs; contribution to overhead theory; depreciation and replacement of equipment; selection of plant; decision to make or buy; and relation between costs and pricing policy. Prerequisite: Business Administration 560. 1 unit.
563. **Controllershship.** The controller in the business organization; his property control responsibilities; internal check; internal audits; insurance; his assistance to operating management through budgeting, break-even analysis, and profitability studies; his relationship with groups outside of management such as investors and government agencies; and emphasis on the manner in which the figure function of controller is used to integrate the operations of the business enterprise. Prerequisite: Business Administration 562 or equivalent. 1 unit.
570. **Mathematical Analysis for Business Decisions.** An elementary course in calculus with applications to business and economics; topics include differentiations, integration, Lagrange multipliers, multivariate functions, and matrices. 1 unit.
572. **Modern and Classical Statistics for Business Decisions.** The application of classical and modern statistics for business decision making. The level of the course assumes some prior knowledge of basic statistics as well as facility with elementary calculus. Prerequisite: Business Administration 570. 1 unit.
573. **The Quantitative Analysis of Decisions.** Introduction to operations research techniques; topics include the construction and solution of linear models under certainty, and the construction of probabilistic models, specifically queueing theory, Markov chains, and sequential decisions. Prerequisite: Business Administration 570. 1 unit.
574. **Application of Operations Research Techniques.** The application of the operations research techniques developed in Business Administration 573 to practical business prob-

lems. Most of the semester is devoted to a series of field research studies. A review of previous work in the field is made prior to the field studies, and the role of the computer in solving operations research problems and its application to the field research is also a major consideration. Prerequisite: Business Administration 573. 1 unit.

575. **Business Simulation.** Introduction to the use of computers in solving business problems; topics include the relation of integrated data-processing systems to information flows within the firm, and the development of simulation models of intrafirm decision processes. Prerequisite: Business Administration 573. 1 unit.
576. **Business Forecasting and Econometrics.** Introduction to maximum likelihood estimating techniques; topics including the use and limitations of least squares, two-stage least squares, limited-information and full-information estimates; and consideration of problems with observational errors, multicollinearity, and autocorrelation in time-series and cross-section structural estimation. A major portion of the course is devoted to the application of the econometric techniques in business forecasting and analysis. Prerequisite: Business Administration 572. 1 unit.
577. **Economics of Decision Making.** The operational analysis of the problems of individual decisions under uncertainty that arise in the practice of management. Prerequisite: Business Administration 572. 1 unit.
578. **Stochastic Models in Management Science.** Application of Markov processes to describe, analyze, and design systems of interest in management science, including queues, inventory, production, brand loyalty, stock market, and other applications. Prerequisite: Mathematics 361 or 363, or equivalent. 1 unit.
579. **Mathematical Programming for Management Science.** Mathematical programming models (linear, integer, quadratic, nonlinear, dynamic, and combinatorial) used to describe, analyze, and design systems such as production, transportation, scheduling, and planning. Prerequisite: Mathematics 315 or equivalent. 1 unit.
582. **International Business Operations, I.** An integration of economics and the functional areas of business focused on the problems of managing international business operations; study of economic, legal, functional, and administrative problems through cases and literature emphasizing financial and marketing problems. Students select one area from the following for special study and reporting: Europe, Latin America, Africa, Middle and Near East, or South Asia and Far East. Prerequisite: Completion of first year of the M.B.A. program. 1 unit.
583. **International Business Operations, II.** Continuation of Business Administration 582. Prerequisite: Business Administration 582. 1 unit.
590. **Independent Study and Research.** Directed reading and research. $\frac{1}{2}$ or 1 unit.
599. **Thesis Research.** Required of all students writing doctoral dissertations in business administration; guidance in writing theses and seminar discussions of interim progress reports. 0 to 4 units.

CATALAN

(See Spanish, Italian, and Portuguese)

CERAMIC ENGINEERING

Head of Department: Professor A. L. Friedberg

Department Office: 204 Ceramics Building, Urbana

190. **Topics in Ceramic Engineering.** Provides an opportunity for freshmen to become acquainted with ceramic engineering; involves discussions and demonstrations on ceramic materials, processes, and properties; construction in laboratory of ceramic articles, glasses, ceramic magnets, and coatings; and discussion of environmental concerns of the ceramic industries as well as the economic structure of the industries. For 2 hours credit, the student will prepare, individually, special glasses and ceramic articles, and measure specific properties. 1 or 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Ceramic Crystal Chemistry.** Crystal structure and crystal chemistry of ceramic materials, including the structure of silicates; geometrical crystallography and discussions of crystal character and crystal growth of ceramic materials. 3 hours.
202. **Ceramic Materials and Processes.** Characterization of ceramic raw materials and their preparation, fabrication, and processing. Prerequisite: Sophomore standing. 3 hours.
205. **Phase Equilibria in Ceramic Systems.** The concepts, interpretations, and utilization of phase equilibrium diagrams in multicomponent ceramic systems at high temperatures; methods of determining equilibrium relationships; and interpretation of binary, ternary, and quaternary systems emphasizing quantitative calculations, metastability, and the origin of microstructure. Lecture and discussion. Prerequisite: Concurrent registration in Chemistry 245 or consent of instructor. 3 hours.
208. **Thermal Processing.** The application of the principles involved in drying and high-temperature operations utilized in processing ceramic materials. Prerequisite: Junior standing in ceramic engineering. 3 hours.
214. **Chemistry and Technology of Glass.** Elementary consideration of the general constitution of glass, unit processes and operations in the preparation of glass, and data on the glass industry; preparation of glasses of various compositions and measurement of important glass properties. Lectures and laboratory. Prerequisite: Junior standing in ceramic engineering, chemistry, or physics. 3 hours.
216. **Rate Processes in Ceramic Engineering.** Reaction kinetics of ceramic processes; high-temperature phase transformations, sintering and grain growth, nucleation and crystal growth from melts; and mechanisms of material transport in solid and liquid systems. Prerequisite: Chemistry 245; junior standing in ceramic engineering. 3 hours.
221. **Pyrometry.** Principles and methods used in high-temperature measurement and introduction to process temperature control. Prerequisite: Junior standing in engineering or equivalent. 2 hours.
222. **Ceramic Coatings.** Compositions and properties of ceramic coatings as porcelain enamels and glazes; preparation of frits; milling; application of slips; firing processes; and discussion of the development of stress and opacity in coatings. Prerequisite: Junior standing in engineering. 3 hours.
271. **Design of High-Temperature Systems.** Design for dryers, kilns, and furnaces for ceramics. Laboratories. Prerequisite: Ceramic Engineering 208; Theoretical and Applied Mechanics 221. 3 hours.
272. **Ceramic Engineering Design.** Design of special equipment for ceramic fabrication processes; factory planning and layout. Laboratories. Prerequisite: Ceramic Engineering 208 271; 2 hours.
297. **Senior Seminar.** Lectures and discussions dealing with professional practice, job selection, employment practice, continuing education, professional growth, and economics of the ceramic industries. Prerequisite: Senior standing in ceramic engineering. 1 hour.
298. **Special Problems.** Special topics in ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser

at the time of registration. Prerequisite: Senior standing. 1 to 2 hours. May be repeated to a maximum of 2 hours.

299. **Senior Thesis.** Research in ceramics and ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. To receive credit, a thesis must be presented. Prerequisite: Senior standing; grade-point average of 4.0 or better. 1 to 5 hours. May be repeated for a maximum credit of 5 hours and a minimum credit of 3 hours.
307. **Thermal and Mechanical Properties of Ceramic Materials.** Interpretations of the thermal and mechanical behavior of real ceramic materials utilizing the atomistic concepts of structure correlated with characterized microstructure. Half of the course treats the mechanism of thermal dilation, heat transport, and emission; the remainder integrates the characterization of deformation, including elastic, anelastic, plastic, and viscous behavior. Temperature dependency is stressed throughout. Lectures and laboratory. Prerequisite: Ceramic Engineering 216 and 331, or equivalent; Theoretical and Applied Mechanics 221. 3 hours or $\frac{3}{4}$ unit.
309. **Whiteware Materials.** The composition and properties of the wide variety of glazes and bodies used in the whiteware field; special emphasis on the single and multioxide component bodies including the structure and properties of the alkaline earth titanates and the ferritic spinels. Prerequisite: Ceramic Engineering 205. 3 hours or $\frac{3}{4}$ unit.
310. **Refractory Technology.** Engineering properties and thermochemistry of polycrystalline materials for use at elevated temperatures including processing of raw materials and the manufacture, heat treatment, quality control, and specification of refractory products; particular emphasis on oxides, silicates, carbides, borides, cermets, and refractory metals with a correlation of the properties of those materials to certain design criteria. Includes laboratory if taken for 1 unit of graduate credit. Prerequisite: Ceramic Engineering 307; senior standing in engineering. 3 hours, or $\frac{3}{4}$ or 1 unit.
311. **Ceramic X-Ray Analysis.** X-ray diffraction for phase identification, for the determination of crystalline lattice parameters, and for the determination of the thermal expansion of crystalline solids; analytical methods of indexing powder diffraction patterns; the determination of precise lattice parameters by means of computer programming and high-temperature x-ray techniques. Prerequisite: Computer Science 101 and senior standing in engineering, chemistry, or geology, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
320. **Advanced Porcelain Enamels.** An advanced study of the field of porcelain enamels with particular emphasis on fundamentals of bond or adherence of enamel metal systems, on opacity and mechanism of color development and measurement, and on the thermal and chemical properties of coatings on metal; specific attention given to coatings for use on metals at elevated temperatures. Prerequisite: Ceramic Engineering 222 or consent of instructor. 2 to 3 hours, or $\frac{1}{2}$ to $\frac{3}{4}$ unit.
331. **Ceramic Microscopy.** Study of the optical activity in isotropic and anisotropic media with particular emphasis on the materials and products of ceramics; the application of these principles and related topics of optical microscopy to the study of the morphology, aggregation, size, and microstructure of the products of high-temperature thermochemical reactions and equilibria. Includes studies in thermal microscopy if taken for 1 unit of graduate credit. Prerequisite: Ceramic Engineering 205 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Electrical Ceramics.** Presentation of the subject of dielectric crystals and their electrical properties; discussion and correlation of ferroelectric and piezoelectric properties of several crystal classes; coverage in detail of the perovskite class of ferroelectric compounds; and discussion of spinel, garnet, and hexagonal type ferrimagnetic crystals and their properties. Prerequisite: Ceramic Engineering 309 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
388. **Nuclear Ceramics.** Same as Nuclear Engineering 388. Study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor; discussion of

material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in nonfissile ceramics, and nuclear carbon, graphite, and nonfuel ceramic isotope utilization. Prerequisite: Chemistry 245 or Physics 383, or consent of instructor. 3 hours or 1 unit.

401. **Ceramic Chemistry.** Silica, silicates, fusions, and phase relations. Prerequisite: Courses in chemistry and physics. 1 unit.
402. **Ceramics.** Chemical and physical phenomena. Prerequisite: Courses in physics and chemistry. 1 to 2 units.
405. **Glass Technology.** Following a brief review of unit processes and operations in glass manufacture, the course treats selected major topics relating to the glass preparation process and the chemical, mechanical, optical, and electrical properties of glass from a dominantly theoretical and research point of view. Prerequisite: Ceramic Engineering 214 or equivalent, or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
406. **Glass Technology.** Dominantly theoretical in approach. Following a survey of the basic theoretical ideas that have been used in the development of the glass model, student readings and reports from the classical and modern literature serve as the basis of class discussions on glass structure and behavior, with emphasis on structure property correlations. Prerequisite: Ceramic Engineering 405 or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
409. **Whiteware Materials.** Advanced study in the field of whitewares, including fundamental considerations of glazes and all types of ceramic bodies; special emphasis on new developments in research and processing; and attention given to the ferroelectric and ferromagnetic properties of electronic ceramics. Prerequisite: Ceramic Engineering 309. 1 to 1 $\frac{1}{2}$ units.
410. **Dielectric Properties of Ceramic Materials.** Review of fundamental properties of vector fields; consideration of the reaction of insulating solids to external electric fields in terms of dielectric theory; the properties of ceramic dielectrics including treatment of ferroelectrics in terms of present theory; and correlation of the piezoelectric properties of ferroelectric crystals and ceramics with the crystal structure, microstructure, and the ferroelectric properties. Prerequisite: Mathematics 345 and 343, or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
412. **Structural Physical Ceramics.** Structural chemistry and crystallization behavior of ceramic systems at elevated temperatures; nucleation, and crystal growth; mineral synthesis; and high-temperature reaction kinetics including phase transformations and diffusion. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy 414 and Mining Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
418. **Physics of Strong Solids.** Characterization and interpretation of physical properties of single-phase and composite materials of high strength; covalently bonded semiconductors; transition-metal carbides; borides and nitrides; graphite; glass; fibers; and precipitation-hardened metals. Prerequisite: Any one of the following: Ceramic Engineering 307 or 421, Metallurgical Engineering 384, Chemistry 342 or Physics 490, or consent of instructor. 1 unit.
421. **Refractory Materials Engineering.** Interpretation of the behavior of materials for utilization in an environment where high-temperature structural stability and control of thermal energy transport are the prime considerations; emphasis on design and material selection criteria based on thermal energy control, mechanical stress response, and structural integrity at elevated temperature. Prerequisite: Ceramic Engineering 310 or consent of instructor. 1 unit.

- 461. Mineralogy of Clays.** Same as Geology 461. The composition of various types of clays; the structure and properties of the clay minerals; and the origin and mode of occurrence of the clay minerals and clay materials. Prerequisite: Geology 336 or equivalent; consent of instructor. 1 unit.
- 462. Mineralogy of Clays.** Same as Geology 462. The properties of clay materials, their relation to the structure of the clay minerals, and methods of determination and control; the utilization of clays in various arts and industries. Prerequisite: Ceramic Engineering 461. 1 unit.
- 495. Materials and Special Problems.** Conference and laboratory. Prerequisite: Graduate standing in ceramic engineering. 0 to 2 units.
- 498. Seminar in Ceramics.** Lectures on current ceramic research and development; presentations by visiting lecturers as well as graduate students and staff in the department. Registration required of all graduate students in ceramic engineering. Graduate students nearing completion of their theses are required to make a seminar presentation. Prerequisite: Graduate standing in ceramic engineering. 0 credit.
- 499. Thesis Research.** Research in any of the branches of ceramics. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 311. 0 to 4 units.

CHEMICAL SCIENCES

(Including Biochemistry, Chemical Engineering, and Chemistry)

Director of School: Professor H. S. Gutowsky
School Office: 106 Noyes Laboratory, Urbana

Biochemistry

Head of Department: Professor L. P. Hager
Department Office: 415 Roger Adams Laboratory, Urbana

- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 290. Thesis.** Limited in general to seniors in biochemistry and chemistry. Each student who desires to do thesis research must receive written permission from a member of the biochemistry faculty. Accordingly, prospective students are encouraged to contact the biochemistry staff in the semester prior to registration in this course. Students must present a thesis to receive credit in this course. Registration of 10 hours over two semesters is expected. Prerequisite: Biochemistry 350 and 355. 4 to 6 hours.
- 350. General Biochemistry.** The chemistry and reactions of constituents of living matter, including carbohydrates, lipids, proteins, nucleic acids, vitamins, coenzymes, and minerals; the chemistry and regulation of the reactions and processes of whole organisms (plant and animal), of organs, cells, and subcellular particles and soluble components. Lectures and assigned readings. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent. 3 hours or $\frac{3}{4}$ unit.
- 351. Physicochemical Bases of Biochemistry.** Introduction to the physicochemical methods and ideas underlying biochemistry. Prerequisite: Chemistry 340 or equivalent course at the undergraduate level, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 354. Introduction to Biochemistry.** Structure and function of living matter, with emphasis on the mammalian organism; designed primarily to meet the needs of veterinary medicine, nutrition, dietetics, and other professional students. Open to other students only by special permission when space is available. Prerequisite: Chemistry 131 or 136, or equivalent; laboratory course in general biology, botany, or zoology; or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

355. **Biochemistry Laboratory.** To accompany Biochemistry 350. Required of all students who expect to take advanced courses in biochemistry. An introduction to experimentation with biochemical systems, processes, and compounds of biochemical importance; identification and quantitative measurement of constituents and transformations in biological systems. Laboratory, quizzes, and assigned readings. Prerequisite: Quantitative analytical chemistry; Chemistry 131 or 136, or equivalent; concurrent registration in Biochemistry 350. 4 hours or 1 unit.
356. **Introduction to Biochemistry Laboratory.** To accompany Biochemistry 354. The isolation, chemical characterization, and function of the structural and catalytic components of living cells; designed primarily to meet the needs of veterinary medicine, nutrition, dietetics, and other professional students. Open to other students only by special permission when space is available. Prerequisite: Chemistry 131 or 136, or equivalent; laboratory courses in general biology, botany, or zoology; or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
440. **Research Topics in Biochemistry.** Same as Chemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications; topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; and light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
450. **Chemistry of Biological Processes.** Consideration at the molecular level of biological processes including bioenergetics, biosynthetic and degradative pathways of cellular components, metabolic regulation, and enzyme reaction mechanisms. Prerequisite: Biochemistry 350 and 355. 1 unit.
452. **Experimental Techniques in Biochemistry.** Experiments concerning the detection, isolation, and characterization of biological macromolecules including enzymes, antibodies, and nucleic acids; methods of studying the size, shape, and hydrodynamic properties of macromolecules, and their interactions between macromolecules and other compounds. Prerequisite: Biochemistry 350 and 355. $\frac{3}{4}$ or 1 unit.
455. **Biochemistry Seminar.** Discussions of current research and literature. Required of all graduate students whose major is biochemistry. Prerequisite: Biochemistry 350 and 355, or equivalent. $\frac{1}{2}$ unit.
490. **Special Topics in Biochemistry.** Designed for students majoring or minoring in biochemistry who wish to undertake individual studies of a non-Ph.D. thesis nature under the direction of a faculty member of the department. Prerequisite: Consent of head of department. $\frac{1}{4}$ to 4 units (summer session, $\frac{1}{4}$ to 2 units).
494. **Chemical Basis of Biological Specificity.** Same as Chemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; and metabolic interrelations of these molecules. Prerequisite: Chemistry 344 and 346; Biochemistry 350 or 450; Microbiology 330; or consent of instructor. $\frac{3}{4}$ unit.
496. **The Use of Carbon-14 in Labeling Techniques.** A comprehensive study of the chemistry of carbon-14. The laboratory work deals with vacuum-line manipulations and synthesis, degradation, and assay of radioactive carbon compounds. Prerequisite: Chemistry 336, 337, and 338, or equivalent; consent of instructor. $\frac{3}{4}$ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

Chemical Engineering

Head of Department: Professor J. W. Westwater

Department Office: 114 Roger Adams Laboratory, Urbana

- 161. The Chemical Engineering Profession.** Lectures and problems on the history and scope of chemical engineering endeavors; decisions and criteria for process development and plant design. Prerequisite: Chemistry 101 or 107. 1 hour.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 261. Introduction to Chemical Engineering.** Lectures and problems on material balances and energy balances; introduction to equilibrium-staged processes. Prerequisite: Chemistry 102 or 108. 3 hours.
- 290. Thesis.** Limited in general to seniors in the curriculum in chemical engineering. Any others must have the consent of the head of the department. Each student taking the course must register in a minimum of 5 hours either in one semester or divided over two semesters. A maximum registration of 10 hours in two semesters is permitted. However, Chemical Engineering 379 (2 hours) may be substituted for 2 of the 5 hours required in Chemical Engineering 290. In order to receive credit, a thesis must be presented by each student registered in Chemical Engineering 290. 2 to 6 hours.
- 368. Selected Topics in Chemical Engineering.** Study of selected topics in chemical engineering; content varies from semester to semester. Typical topics are optimization, chemical kinetics, phase equilibrium, biochemical engineering, kinetic theory, and transport properties. Prerequisite: Senior standing in chemical engineering or consent of instructor. 2 or 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
- 370. Chemical Engineering Thermodynamics.** Fundamental concepts and laws of thermodynamics with emphasis on application to chemical engineering problems; introduction to phase equilibria. Prerequisite: Chemical Engineering 261. 3 hours or $\frac{1}{2}$ unit.
- 371. Fluid Mechanics and Heat Transfer.** Introduction to fluid statics and dynamics; dimensional analysis: design of flow systems; and introduction to heat transfer conduction, convection, and radiation. Prerequisite: Chemical Engineering 261 or consent of instructor. 4 hours or 1 unit.
- 373. Mass Transfer Operations.** Introduction to the theory of mass transfer; design of separation processes; and application to multicomponent systems. Prerequisite: Chemical Engineering 371 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 374. Chemical Engineering Laboratory.** Experiments and computation in fluid mechanics, heat transfer, reaction kinetics, and separation processes. Prerequisite: Credit or concurrent registration in Chemical Engineering 373. 3 hours or $\frac{1}{2}$ unit.
- 377. Dynamics and Control of Chemical Systems.** Theory and experiments covering introductory topics in process dynamics and control with special emphasis on chemical systems, including mathematical modeling, system dynamics, feedback control, computer control, and analog simulation. Prerequisite: Chemical Engineering 371; Mathematics 345; Computer Science 101. 3 hours or $\frac{3}{4}$ unit.
- 379. Chemical Engineering Projects.** Laboratory; development of an individual project. Prerequisite: Senior standing in chemistry or chemical engineering. 2 hours or $\frac{1}{2}$ unit.
- 380. Heat, Mass, and Momentum Transport.** A unifying treatment of physical rate processes with particular emphasis on the formulation and solution of typical boundary value problems associated with heat, mass, and momentum transport. Prerequisite: Chemical Engineering 371 or consent of instructor; Mathematics 343 or 345. 3 hours or $\frac{3}{4}$ unit.
- 381. Chemical Reaction Engineering.** Chemical kinetics, chemical reactor design, and the interrelationship of transport and chemical reaction in open and closed systems. Prerequisite: Chemical Engineering 373. 2 hours or $\frac{1}{2}$ unit.
- 382. The Prediction of Physical Properties.** Prediction of equilibrium and transport properties in gases, liquids, and solids. Prerequisite: One year of physical chemistry. 2 hours or $\frac{1}{2}$ unit.

384. **Process Design.** Analysis and design of chemical process systems. Prerequisite: Credit or concurrent registration in Chemical Engineering 381. 1 to 3 hours, or $\frac{1}{4}$ to $\frac{3}{4}$ units.
386. **Introduction to Air Pollution.** Lectures and discussion of the sources, dispersion, reactions, and control of air pollutants. Prerequisite: Credit or concurrent registration in Chemical Engineering 373 or consent of instructor. 2 or 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit.
465. **Chemical Engineering Seminar.** Required of all graduate students whose major is chemical engineering. Prerequisite: Chemical Engineering 373. $\frac{1}{4}$ unit.
466. **Applied Mathematics in Chemical Engineering.** The development of mathematical models and a survey of modern mathematical methods currently used in the solution of chemical engineering problems; topics include the application of vectors and matrices, partial differential equations, numerical analysis, and methods of optimization in chemical engineering. Prerequisite: Consent of instructor. $\frac{3}{4}$ or 1 unit.
468. **Properties of Fluids.** The kinetic theory of gases and the prediction of transport coefficients; statistical mechanics applied to dense gases and liquids; and theories of solutions. Prerequisite: A background in modern physical chemistry and physics; consent of instructor. $\frac{3}{4}$ or 1 unit.
469. **Special Topics in Chemical Engineering.** Various advanced topics; generally taken during the second year of graduate study. Typical topics include turbulence, hydrodynamic instability, process dynamics, interfacial phenomena, reactor design, properties of matter at high pressure, and phase transitions. This course may be repeated. Prerequisite: Chemical Engineering 464. $\frac{3}{4}$ or 1 unit.
487. **Fluid Dynamics.** Basic concepts in fluid dynamics with special emphasis on topics of interest to chemical engineers; derivation of the Navier-Stokes equations; solutions for creeping flow, for perfect fluids, and for boundary layers; non-Newtonian fluids; and turbulence. Prerequisite: Chemical Engineering 464. 1 unit.
488. **Advanced Topics in Heat and Mass Transfer.** Principles of transfer operations developed in terms of physical rate processes; boundary layer heat and mass transfer, eddy diffusion, phase changes, and separation processes. Prerequisite: Chemical Engineering 464 or consent of instructor. $\frac{3}{4}$ or 1 unit.
496. **Individual Study.** Study under the supervision of a staff member in areas not covered in course offerings. Prerequisite: Consent of the staff member under whom the study is to be made. 0 to 1 unit.
497. **Special Problems.** Individual work on problem-oriented projects not included in theses. This could be research, engineering design, or professional work in chemical engineering which has educational values. The work must be done under the supervision of a staff member with the approval of the department head. $\frac{1}{2}$ to 4 units.
498. **Research Seminar.** Discussion of recent developments of importance to different areas of chemical engineering research. The course is divided into a number of sections, and subject matter differs from section to section and from time to time. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated for credit.
499. **Thesis Research.** Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in another department must receive permission from the head of the Department of Chemical Engineering to register in this course. 0 to 4 units.

Chemistry

Head of Department: Professor H. S. Gutowsky

Department Office: 106 Noyes Laboratory, Urbana

100. **Introductory Chemistry.** Lectures and recitations. For students not prepared to enroll in Chemistry 101 or 107. No previous credit in high school chemistry is presumed. Pre-

requisite: Two and one-half units in high school mathematics, or credit or concurrent registration in Mathematics 111 or 112. 2 hours.

101. **General Chemistry.** Lectures, recitations, and laboratory. For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry and energetics in chemical systems. Students may not receive credit for both Chemistry 101 and 107. Prerequisite: Credit in or exemption from Mathematics 111 or 112. 4 hours.
102. **General Chemistry.** Lectures, recitations, and laboratory. Applications of principles to typical chemical systems: equilibria, transition elements, nonmetals, and organic and biochemical systems. Students may not receive credit for both Chemistry 102 and 108. Prerequisite: Chemistry 101 or 107, or advanced placement credit for one semester of college-level chemistry. 4 hours.
103. **General Chemistry: Organic Chemical Studies.** Lectures, recitations, and laboratory-discussion; descriptive facts and theory of organic chemistry and applications to living processes. For students in the College of Agriculture. A terminal course in chemistry; does not meet Chemistry 102 prerequisite for more advanced courses in chemistry. Prerequisite: Chemistry 101. 4 hours.
107. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Students may not receive credit for both Chemistry 107 and 101. Credit toward graduation is received in Chemistry 107 only if Chemistry 109 is also completed. Prerequisite: One year of high school chemistry with at least a "B" average grade; credit or concurrent registration in Mathematics 120; concurrent registration in Chemistry 109. 3 hours.
108. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Credit toward graduation is received in Chemistry 108 only if Chemistry 110 is also completed. Students may not receive credit for both Chemistry 108 and 102. Prerequisite: Chemistry 107 and/or 109; concurrent registration in Chemistry 110. 3 hours.
109. **General Chemistry Laboratory.** Laboratory and discussions. To be taken with Chemistry 107. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without concurrent registration in Chemistry 107. 2 hours. Students with credit in Chemistry 101 may take Chemistry 109 for a maximum of 1 hour.
110. **General Chemistry Laboratory.** To be taken with Chemistry 108. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without registration in Chemistry 108. 2 hours. Students with credit in Chemistry 102 may take Chemistry 110 for a maximum of 1 hour.
122. **Elementary Quantitative Analysis.** Stoichiometrical relations applied in volumetric and instrumental analysis: theory and practical application of theory in making chemical measurements. Prerequisite: Chemistry 102 or equivalent. 3 hours.
131. **Elementary Organic Chemistry.** Basic structural and synthetic organic chemistry is presented with emphasis on applications of this material to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Equivalent to the lecture portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 131 and Chemistry 136. Prerequisite: Chemistry 102 or 108. 3 hours.
134. **Elementary Organic Chemistry Laboratory.** Basic laboratory technique in organic chemistry is presented with emphasis on experiments of interest to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Equivalent to the laboratory portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 134 and 181. Prerequisite: Credit or concurrent registration in Chemistry 131. 2 hours.
136. **Basic Organic Chemistry.** Fundamental structural, synthetic, and mechanistic organic chemistry is presented. For students whose major is chemistry or for those registering in

the curriculum in chemistry or chemical engineering. Students may not receive credit for both Chemistry 136 and 131. Prerequisite: Chemistry 108 or 122; concurrent registration in Chemistry 181; Mathematics 130, 131, or 135. 3 hours.

181. **Structures and Synthesis.** A laboratory course emphasizing molecular structure and synthetic chemistry. Students may not receive credit for both Chemistry 181 and 134. Prerequisite: Chemistry 108 or 122; Mathematics 130, 131, or 135; credit or concurrent registration in Chemistry 136. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
245. **Physical Chemistry for Engineers.** Primarily for ceramists, metallurgists, and other engineering students; not offered to chemistry or chemical engineering majors. Provides the elements of chemical thermodynamics and chemical kinetics, and provides an introduction to the statistical concepts of entropy. Prerequisite: Chemistry 102; Physics 107 or 108; Mathematics 140 or 141, or equivalent. 3 hours.
290. **Thesis.** Research, with thesis, under the direction of a senior staff member in chemistry. Normally the student takes two semesters of Chemistry 290 in his senior year. The course is recommended for all those who plan to do research and graduate study, and it or Biochemistry 290 is a prerequisite for graduation with distinction in chemistry. In the semester preceding their initial enrollment, those interested in taking the course should consult with their advisers and with the graduate adviser for the area of interest in which they plan to work. A maximum of 10 hours may be counted toward graduation and a thesis must be presented for credit to be received. 2 to 6 hours.
315. **Inorganic Chemistry.** Nuclear and extranuclear atomic structures and their relation to the properties of the elements and their compounds; types of bonding; survey of the periodic relationships; preparation and applications of the elements and their compounds. Prerequisite: Credit or concurrent registration in physical chemistry. 3 hours or $\frac{3}{4}$ unit.
316. **Inorganic Chemistry Laboratory.** Preparation of typical inorganic compounds illustrating special and advanced techniques, including characterization by modern physical methods. Prerequisite: Chemistry 383, or credit or concurrent registration in Chemistry 315, or equivalent. 3 hours or $\frac{3}{4}$ unit.
322. **Special Topics in Instrumental Analysis and Separation Methods.** Theory, practice, and instrumentation of gas, liquid, ion-exchange, gel chromatography, electrophoresis, mass spectrometry, combination GC-MS, nuclear magnetic resonance, electron spin resonance, Raman spectroscopy, and electron spectroscopy. Prerequisite: Credit or concurrent registration in Chemistry 340 or 342. 4 hours or 1 unit.
323. **Applied Electronics for Scientists.** A lecture and laboratory course designed expressly for chemists and other scientists or engineers who have little or no background in electronics, but who need a working knowledge of electronic devices, circuits, and instruments; begins with electronic principles and leads systematically into digital, analog, and servo systems used in scientific instrumentation. Prerequisite: Senior or graduate standing in any of the physical sciences or engineering, or consent of instructor. 4 hours or 1 unit.
328. **Principles of Environmental Chemistry.** Presentation of the chemical principles underlying air and water chemistry with strong emphasis on the behavior of environmental pollutants; detailed discussion of the chemistry of production of pollutants and their effects. Prerequisite: Chemistry 340, or Chemistry 336 and Physics 102, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
329. **Instrumental Methods in Environmental Science.** Designed to acquaint chemistry majors and nonmajors with the instrumental techniques used to analyze and characterize environmental samples with particular emphasis on the measurement of pollutant species; discussion of the following topics with emphasis on sample preparation and interpretation of results: electrochemical methods, UV/visible and IR spectroscopy, fluorimetry, atomic spectroscopy, mass spectrometry, activation analyses, microscopic techniques, and chromatography. Prerequisite: Chemistry 229, or concurrent registration in Chemistry 340 or 342, or consent of instructor. 4 hours or 1 unit.

- 336. Organic Chemistry.** Second course. Lectures and recitations. Prerequisite: Chemistry 131 and 134, or Chemistry 136 and 181. 3 hours or $\frac{3}{4}$ unit.
- 337. Organic Chemistry.** Laboratory experiments in organic chemistry with emphasis on synthesis. Prerequisite: Credit or concurrent registration in Chemistry 336. 3 hours or $\frac{3}{4}$ unit.
- 338. Separation, Purification, and Identification of Organic Compounds.** Separation, purification, and identification of organic compounds using modern research methods; the identification of organic compounds by the use of spectroscopic methods and chemical conversion; the separation of mixtures and the purification of the components by crystallizations, sublimation, distillation, extraction, and chromatography; and the qualitative and quantitative identification of the components of a mixture. Prerequisite: Chemistry 336 and 337. 4 hours or 1 unit.
- 339. Advanced Organic Chemistry.** Interpretation of reactivity, reaction mechanisms, and intermediates; applications in organic synthesis, photochemistry, biosynthesis of natural products, and other areas. Prerequisite: Chemistry 338. 3 hours or $\frac{3}{4}$ unit.
- 340. Principles of Physical Chemistry.** A one-semester course in physical chemistry emphasizing topics most important to students in the biological and agricultural sciences. Not open to students in the specialized curricula in chemistry and chemical engineering. Laboratory experience in this area provided by Chemistry 383 to be taken preferably after Chemistry 340. Prerequisite: Chemistry 122 and 131, or equivalent; Physics 102; Mathematics 130 or equivalent (calculus including partial derivatives). 4 hours or 1 unit.
- 342. Physical Chemistry.** This course and Chemistry 344 constitute a year-long study of chemical principles, covering topics such as atomic and molecular structure, properties and thermodynamics of gases, liquids, crystals, phase equilibria, solutions, surface chemistry, chemical equilibrium, electrochemistry, chemical thermodynamics, and chemical kinetics. Students should not enroll in Chemistry 342 who do not intend to take Chemistry 344. Prerequisite: Chemistry 108, 122, or 123, or equivalent; Physics 106, 107, and 108, or two semesters of general physics with concurrent registration in the third semester; credit or concurrent registration in Mathematics 140 or equivalent. 3 hours or $\frac{3}{4}$ unit.
- 344. Physical Chemistry.** Continuation of Chemistry 342. Prerequisite: Chemistry 342. 3 hours or $\frac{3}{4}$ unit.
- 346. Physical Chemistry of Macromolecules.** The physical properties of systems containing large molecules, with special emphasis on proteins, nucleic acids, and high polymers; the use of physical methods for the characterization of such substances. Prerequisite: Chemistry 340 or 344. 3 hours or $\frac{3}{4}$ unit.
- 348. Advanced Physical Chemistry.** The sequence, Chemistry 348 and 349, is designed to give seniors and graduate students a unified treatment of physical chemistry on an advanced level; topics include the electronic structure and spectra of atoms, principles of wave mechanics, experimental and theoretical aspects of the chemical bond in diatomic and polyatomic molecules, statistical thermodynamics, and chemical kinetics. Prerequisite: Chemistry 344 or equivalent. 4 hours or 1 unit.
- 349. Advanced Physical Chemistry.** Continuation of Chemistry 348. Prerequisite: Chemistry 348. 4 hours or 1 unit.
- 383. Dynamics, Structure, and Physical Methods.** Laboratory presenting the relationship of dynamics and structure with emphasis on the use of physical methods to follow the course of reactions. Prerequisite: Chemistry 181 or 134; credit or concurrent registration in Chemistry 342, or credit in Chemistry 340. 2 hours or $\frac{1}{2}$ unit.
- 385. Chemical Fundamentals.** Laboratory with experiments on the fundamental physical nature of chemical phenomena. Prerequisite: Chemistry 342 and 383; credit or concurrent registration in Chemistry 344. 4 hours or 1 unit.
- 392. Applied X-Rays.** Generation and detection of x-rays; absorption and scattering of x-rays by matter; crystals; crystal and molecular symmetry; techniques of x-ray diffrac-

tion; identification and analyses; and deduction of atomic positions. Prerequisite: Chemistry 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

395. **History of Science with Particular Reference to Chemistry.** Prerequisite: Twenty hours of laboratory science. 2 hours or $\frac{1}{2}$ unit.
396. **Atomic Physics.** Same as Physics 381. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules; topics discussed include evidence for the atomic nature of matter, the properties of free electrons and ions, photons and their interaction with matter, atomic spectra and structure, molecular spectra and structure, and an introduction to the ideas of quantum mechanics. Students may not receive credit for Chemistry 396 and Physics 386. Prerequisite: General physics; Mathematics 343 or 345. It is recommended that chemistry majors take Chemistry 344 before registering in this course. 4 hours or 1 unit.
397. **Radiochemistry.** Same as Nuclear Engineering 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
398. **Radiochemistry Laboratory.** Same as Nuclear Engineering 398. To accompany Chemistry 397. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. Laboratory and discussion. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
404. **Advanced Inorganic Chemistry Laboratory.** Specialized laboratory techniques; more difficult inorganic syntheses. Prerequisite: Credit or concurrent registration in one of the lecture courses in inorganic chemistry in the 400 series. $\frac{1}{4}$ to $\frac{3}{4}$ unit.
405. **Inorganic Chemistry Seminar.** Required of all graduate students whose major is inorganic chemistry. $\frac{1}{4}$ unit.
406. **Physical Inorganic Chemistry.** Qualitative description of the bonding in inorganic compounds; use of physical methods to provide information about the structure and reactions of inorganic compounds; and structures and reactions of inorganic compounds in solution. Prerequisite: Chemistry 315 and 344. 1 unit.
407. **Special Topics in Inorganic Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as organometallic chemistry, advanced ligand field theory and molecular orbital theory of inorganic compounds, kinetics and mechanisms of inorganic reactions, etc. Prerequisite: Chemistry 406 or consent of instructor. $\frac{1}{2}$ to 1 unit. May be repeated for credit.
408. **The Chemistry of Complex Inorganic Compounds.** The nature of the coordinate bond; applications of complex compounds. Prerequisite: Chemistry 315. 1 unit.
421. **Spectrochemical Methods of Analysis.** Emission spectroscopy; Raman spectroscopy; mass spectrometry; ultraviolet, visible, infrared, and microwave absorption spectroscopy; and colorimetry, fluorimetry, interferometry, and polarimetry. Lectures and laboratory. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree. 1 unit.
422. **Electrical Methods of Chemical Analysis.** Polarography, potentiometric, amperometric, and conductometric titrations, and other selected topics. Lectures and laboratory. Prerequisite: Chemistry 344 or equivalent. 1 unit.
423. **Electron Microscopy.** Same as Biology 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission of electron microscopes and its modern variants, including lectures and demonstrations of modern high-vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics; consent of instructor. $\frac{1}{2}$ unit.
424. **Quantitative Analysis.** Advanced principles including chemical statistics, calculations, experimental methods, and applications. Prerequisite: Graduate standing in chemistry. $\frac{1}{2}$ unit.

425. **Analytical Chemistry Seminar.** Required of all graduate students whose major is analytical chemistry. $\frac{1}{4}$ unit.
427. **Applied X-Rays: Crystallography.** Prerequisite: Training in physics and physical chemistry. $\frac{3}{4}$ unit.
429. **Electron Microscopy with Laboratory.** Same as Biology 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate sections to meet special needs of biologists, geologists, and those interested in electron diffraction. Most theory lectures may be omitted by those enrolled or having credit in Biology 423 or Chemistry 423. Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics; two semesters of college mathematics; three semesters of chemistry; consent of instructor. 1 unit.
431. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on reaction mechanisms and synthesis. Prerequisite: Chemistry 336; one year of physical chemistry. 1 unit.
432. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on structure. Prerequisite: Chemistry 431 or 336. 1 unit.
433. **Organic Chemistry.** Special topics in organic chemistry. An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as natural product synthesis and biosynthesis, organic photochemistry, chemistry of special families of organic compounds, etc. Prerequisite: Chemistry 431 and 432, one of which may be taken concurrently. $\frac{1}{2}$ or $\frac{3}{4}$ unit. Two lectures per week are required for $\frac{3}{4}$ unit credit. May be repeated for credit.
434. **Advanced Organic Synthesis.** Lecture and laboratory. $\frac{1}{4}$ to 1 unit.
435. **Organic Chemistry Seminar.** Current literature in organic chemistry. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
436. **Experimental Organic Chemistry.** A lecture course on research techniques in organic chemistry. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit.
440. **Research Topics in Biophysical Chemistry.** Same as Biochemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications; topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; and light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
441. **Thermodynamics and Statistical Thermodynamics.** Fundamentals of classical thermodynamics with emphasis on equilibrium and stability criteria; an introduction to equilibrium statistical mechanics with discussion of several ensembles and applications to ideal systems of interest to chemists; and introduction to nonequilibrium thermodynamics. Prerequisite: Chemistry 342 and 344, or equivalent. 1 unit.
442. **Statistical Mechanics.** Fundamentals of equilibrium statistical mechanics with selected applications to interacting classical fluids: dense gases, solutions, liquids, plasmas, and ionic solutions; introduction to nonequilibrium statistical mechanics and linear response theory. Prerequisite: Chemistry 348 and 441, or equivalent, or consent of instructor. 1 unit.
443. **Quantum Dynamics.** The quantum mechanical description of time-dependent processes, including discussions of the time-dependent Schrodinger equation, approximations, interaction of matter with radiation, wave packets, elastic and inelastic scattering, and relaxation phenomena. Prerequisite: Concurrent registration in Chemistry 348 or consent of instructor. 1 unit.
445. **Physical Chemistry Seminar.** Required of all graduate students whose major is physical chemistry. Prerequisite: Consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.

447. **Approximation Methods in the Quantum Mechanics of Collisions.** Designed for entering and higher graduate students; treats several approximation methods in the quantum mechanics of collisions, principally the semiclassical method; develops portions of theoretical mechanics and complex variables employed for handling semiclassical solutions; and considers elastic, inelastic, and reactive collisions. Prerequisite: Consent of instructor. 1 unit.
448. **Chemical Kinetics.** Chemical reaction and theory of rate processes. Lectures. Prerequisite: Chemistry 441 or consent of instructor. $\frac{3}{4}$ unit.
449. **Special Topics in Physical Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as molecular spectroscopy, statistical mechanics, radiation and hot-atom chemistry, molecular quantum mechanics, radio-frequency spectroscopy, advanced experimental methods, kinetics of irreversible processes and cooperative phenomena, etc. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. Students may register for credit more than once.
490. **Special Topics in Chemistry.** Designed for students majoring or minoring in chemistry who wish to undertake individual studies of a non-Ph.D. thesis nature under the direction of a faculty member of the department. Prerequisite: Consent of instructor and of head of department. Staff for the course is the same as for Chemistry 499. $\frac{1}{4}$ to 4 units.
493. **Advanced Electron Microscopy.** Same as Biology 493. Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, and the analysis and study of varied materials by use of transmission and/or scanning electron microscopes and by the techniques of electron diffraction. Open to qualified graduate students in all departments. Prerequisite: Biology 429 or Chemistry 429; consent of instructor. $\frac{1}{4}$ to $\frac{1}{2}$ unit.
494. **Chemical Basis of Biological Specificity.** Same as Biochemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; and metabolic interrelations of these molecules. Prerequisite: Chemistry 344 and 346; Biochemistry 350 or 450; Microbiology 330; or consent of instructor. $\frac{3}{4}$ unit.
496. **The use of Carbon-14 in Labeling Techniques.** Same as Biochemistry 496. A comprehensive study of the chemistry of carbon-14; the laboratory work deals with vacuum-line manipulations and synthesis, degradation, and assay of radioactive carbon compounds. Prerequisite: Chemistry 336, 337, and 338, or equivalent; consent of instructor. $\frac{3}{4}$ or 1 unit.
499. **Thesis Research.** A candidate for the master's degree who elects research is required to present a thesis. A thesis is always required of students working toward the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in a department other than of chemistry and chemical engineering must receive permission from the head of the School of Chemical Sciences to register in this course. 0 to 4 units.

CHINESE

(See Asian Studies)

CIVIL ENGINEERING

Head of Department: Professor C. P. Siess

Department Office: 1114 Civil Engineering Building, Urbana

- 195. Introduction to Civil Engineering.** A civil engineering orientation course including historical developments, educational requirements, relation to science, professional practice, and specialties in the profession. Prerequisite: Sophomore standing in civil engineering. 1 hour.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 201. Engineering Surveying.** Introduction to surveying and photogrammetry. Prerequisite: Civil Engineering 293; credit or registration in Computer Science 101. 4 hours.
- 205. Construction and Route Surveying.** Principles of construction layout and route location; data collection; horizontal and vertical alignment; and earthwork. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.
- 214. Properties and Behavior of Concrete.** Engineering properties of plain concrete; influence of cements, aggregates, water, and mixtures on the properties of concrete; structure of gel and concrete; design of mix; behavior under various types of loading and environments; and fracture, creep, and durability. Laboratory practice is an important part of the course. Prerequisite: Theoretical and Applied Mechanics 223 or 224; junior standing in engineering or architecture. 2 hours.
- 216. Construction Engineering.** Introduction to the construction processes: contracting and bonding, planning and scheduling, estimating and project control, scientific productivity models, and construction econometrics. Prerequisite: Civil Engineering 292; credit or concurrent registration in Computer Science 101 and Civil Engineering 293. 3 hours.
- 220. Materials for Transportation Facilities.** Materials for the construction of transportation roadways including soils, aggregates, soil-aggregates, bituminous materials, asphaltic mixtures, and stabilized soils; emphasis on properties, behavior, mixture analysis, and quality control. Prerequisite: Theoretical and Applied Mechanics 221 or consent of instructor. 3 hours.
- 221. Analysis and Design of Roadways.** Behavior, performance, and structural design of roadways for highways, airfields, railroads, and rapid transit; topics also considered: environmental factors, maintenance, and pavement economics. Prerequisite: Credit or concurrent registration in Civil Engineering 280, or consent of instructor. 3 hours.
- 230. Introduction to Transportation Engineering.** Introduction to engineering principles common to all types of transportation; historical development and present systems of transport; technoeconomic characteristics of airways, highways, pipelines, railroads, and waterways; coordination and integration; and planning for transport use. Prerequisite: Junior standing in engineering, architecture, or urban and regional planning, or consent of instructor. 3 hours.
- 231. Introduction to Transportation Systems.** Consideration of the interaction between engineering, social, economic, and political conditions in planning and designing transportation systems; included in transportation system planning are concepts of forecasting traffic demand, network design, trip distribution, and evaluation of alternative systems for that demand. Prerequisite: Civil Engineering 230 and 292, or consent of instructor. 3 hours.
- 240. Control of the Urban Environment.** Discussion of the quality of the urban environment and identification of the sources and causes of deterioration of this environment; discussion of effects of air pollution, water pollution, refuse disposal, housing and land-use planning, along with methods and programs for control. Prerequisite: Junior standing. 3 hours.
- 241. Water Quality and Water Pollution.** Water quality and quality criteria for domestic and industrial usages; sources and types of pollution; fate of pollution and its effect on

- the environment; and role of pollution in water resources management. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours.
255. **Introduction to Hydrosystems Engineering.** Introduction to design and analysis of systems directly concerned with the occurrence and flow of water; quantitative introduction to the three basic areas of hydrology, hydraulic engineering, and water resources planning. The topics are introduced in the context of a water system and emphasis is on their engineering significance. Prerequisite: Theoretical and Applied Mechanics 235 or equivalent; credit or concurrent registration in Civil Engineering 292 and 293, or equivalent. 3 hours.
261. **Introduction to Structural Engineering.** Basic topics in the analysis, behavior and design of trusses and framed structures under static loads; analysis topics including member forces in trusses, shear and moment diagrams, deflections, simple applications of the force method and slope-deflection; and an introduction to computer applications by means of a general purpose structural analysis program. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
262. **Analysis of Framed Structures.** Comprehensive study of the force and displacement of methods of analysis of framed structures; influence functions; curves of maxima; and use of computer structural analysis programs. Prerequisite: Civil Engineering 261. 3 hours.
263. **Behavior and Design of Metal Structures, I.** Introduction to the design of metal structures; behavior of members and their connections; and theoretical, experimental, and practical bases for proportioning members. Prerequisite: Theoretical and Applied Mechanics 224; Civil Engineering 261. 3 hours.
264. **Reinforced Concrete Design, I.** Study of the strength, behavior, and design of reinforced concrete members subjected to moments, shear, and axial forces; extensive discussion of the influence of the material properties on behavior. Prerequisite: Civil Engineering 261; Theoretical and Applied Mechanics 224. 3 hours.
280. **Introduction to Soil Mechanics and Foundation Engineering.** Classification of soils, compaction in the laboratory and in the field, soil exploration, boring and sampling, one-dimensional settlement analyses, strength, bearing capacity of foundations, and stability of retaining walls and slopes. Prerequisites: Theoretical and Applied Mechanics 221. 3 hours.
290. **Legal Aspects of Engineering Contracts and Specifications.** Same as General Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; and business and technical clauses of specifications. Credit is not given for both Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
292. **Design and Planning of Civil Engineering Systems.** Introduction to the synthesis and design of systems dependent upon civil engineering technology; the structuring, modeling, and simulation of such systems; and the role of the decision maker and the use of optimal principles in engineering planning. Prerequisite: Integral calculus. 3 hours.
293. **Stochastic Concepts in Civil Engineering.** Identification and modeling of nondeterministic problems in civil engineering, and the treatment thereof relative to engineering design and decision making; development of stochastic concepts and simulation models, and their relevance to real design and decision problems in various areas of civil engineering. Prerequisite: Integral calculus. 3 hours.
295. **Professional Practice.** A series of lectures by outstanding authorities on the practice of civil engineering and its relations to economics, sociology, and other fields of human endeavor. Lectures are given approximately once a week. Prerequisite: Junior standing. 0 credit.
297. **Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by the department. Prerequisite: Senior standing. 1 to 4 hours.

- 307. Photogrammetric Engineering.** Study of metrical photography in civil engineering practice; analytical and analogue photogrammetric systems; photometrics and outer space mapping techniques; and automated photographic mapping systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 309. Geodetic Engineering.** Geodetic positioning on a reference ellipsoid, least squares adjustment of first-order triangulation and trilateration nets using observation equations, satellite triangulation, principles and operations of modern instruments, geodetic levelling, map projections, and rational design of geodetic systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
- 315. Construction Productivity.** Introduction to the application of scientific principles to the measurement and forecasting of productivity in construction engineering; conceptual and mathematical formulations of the labor, equipment, and material factors affecting productivity. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 316. Construction Planning and Control.** Project definition; scheduling and control models; material, labor, and equipment allocation; optimal schedules; project organization; documentation and reporting systems; and management and control. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 318. Construction Cost Analyses and Estimates.** Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; and the fundamentals of cost recording for construction cost accounts and cost controls. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 321. Bituminous Material and Mix Design.** Properties and control testing of bituminous materials; analysis of bituminous paving mixtures; and composition and design of asphaltic concrete and soil-asphalt mixes. Prerequisite: Civil Engineering 214 and 220, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 322. Development of Highway Facilities.** Analysis of factors in developing a highway transportation facility; traffic estimates and assignment; problems of highway geometrics and design standards; planning and location principles; intersection design factors; street systems and terminal facilities; programming improvements; drainage design; structural design of surface; concepts of highway management and finance; and highway maintenance planning. Prerequisite: Civil Engineering 220 or consent of instructor. 4 hours or 1 unit.
- 325. Highway Traffic Characteristics.** Vehicle operating characteristics, driver characteristics, pedestrian characteristics, and roadway characteristics; their individual and collective relationships as traffic stream characteristics to the planning, design, and operation of highway facilities. Prerequisite: Civil Engineering 230 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 333. Urban and Regional Transportation.** Importance of transportation and its relation to urban and regional planning; characteristics of transport systems; transportation planning including surveys, data analysis, and problems of administration and finance; and coordination and integration of transport. Prerequisite: Senior or graduate standing, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 334. Airport Design.** Basic principles of site selection for airports and fundamental considerations of design, construction, and maintenance of airport pavements and structures. Prerequisite: Civil Engineering 220 and senior standing in civil engineering, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 335. Railway Construction and Maintenance.** Loads and load distribution on track and subgrade; roadbed construction and stabilization; track stresses, design and materials; turnouts and crossings; and maintenance programs. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.

336. **Railway Location and Operation.** Influences of traffic, alignment, distance, gradients, and motive power upon operating expenses; mechanics of train operation; and economic design of location. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Signals.** Train movements; systems of signals; track circuits; track capacity; interlockings; and economics of signaling. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 2 hours, or $\frac{1}{2}$ or 1 unit.
338. **Terminals.** Design, location, and operation of freight terminal facilities for rail, highway, air, and water carriers; passenger terminals; special terminal requirements for specific commodity categories; and coordination with and relation to land use and urban planning. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.
340. **Physical Principles of Environmental Engineering Processes.** Analysis of the physical principles which form the basis of many water and air quality-control operations; sedimentation, filtration, inertial separations, flocculation, and mixing and principles of reactor design. Prerequisite: Civil Engineering 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
341. **Air Resources Management.** Examination of the management of the air resources for a large urban area using dynamic operational gaming simulation techniques; focus on the law, technology, administration, and politics associated with the control of air resources. Prerequisite: Senior or graduate standing, or consent of instructor and credit in an introductory course in air pollution control. 2 hours or $\frac{1}{2}$ unit.
342. **Water Quality Control Processes.** Fundamental theory underlying the unit processes utilized in the treatment of water for domestic and industrial usage, and in the treatment of domestic and industrial wastewaters. Prerequisite: Credit or concurrent registration in Civil Engineering 241. 3 hours or $\frac{3}{4}$ unit.
343. **Chemical Principles of Environmental Engineering Processes.** Application of principles of chemical equilibrium, surface chemistry, chemical kinetics, and photochemistry to air and water quality considerations; carbonate and phosphate systems in natural waters; dissolved gases; hardness; hydrolysis of coagulants; corrosion; chemistry of disinfectants; removal of impurities by adsorption; and reactions of various pollutants in the atmosphere. Prerequisite: Civil Engineering 342 or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
344. **Solid Wastes Management.** Analysis of the quantities, sources, and characteristics of solid wastes and associated trends; effects of refuse on the environment; establishment and operation of collection systems; transportation of refuse to disposal site; reclamation and reuse systems; and design of disposal systems and optimization of management systems. Prerequisite: Consent of instructor. 4 hours or 1 unit.
345. **Environmental Health Engineering.** Application of engineering principles to the control of environmental sanitation and communicable disease control, including administration, biostatistics, epidemiology, vector control, pesticides, milk and food sanitation, swimming pools, individual water supply and wastewater disposal, plumbing, refuse collection and disposal, industrial hygiene and air pollution, radiological health, and international health. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
346. **Biological Principles of Environmental Engineering Processes.** Application of principles of organic chemistry, biochemistry, and biology to air and water quality, wastes, and their engineering management; biologically mediated changes in water and in domestic and industrial wastewater; biological contaminants of air; and solid waste disposal. Prerequisite: Civil Engineering 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
347. **Aquatic Ecology.** Same as Zoology 359. An integrated study of the environmental factors affecting the composition and distribution of biota in lakes, rivers, and estuaries;

emphasis on the nature of the response of aquatic ecosystems to stress, and practical means of aquatic resource management. Prerequisite: Credit or concurrent registration in Civil Engineering 346 or Zoology 343, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

348. **Air Pollution Seminar.** Same as Agricultural Engineering, General Engineering, Geography, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as health effects and economic damage of air pollution, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or $\frac{1}{2}$ unit.
349. **Nuclear Radiation Protection.** Same as Nuclear Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry, sources of ionizing radiation, determination of radiation tolerances, dosimetric instruments, and standards and regulations. Prerequisite: Credit or concurrent registration in Nuclear Engineering 397 or Physics 382. 4 hours or 1 unit.
350. **Hydrology.** An applied course on hydrology dealing with environmental water problems; discussion of principles of hydrologic systems and their components; and presentation of methods of analysis and their applications to various purposes of water resources planning and development. Prerequisite: Civil Engineering 255 or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
351. **Hydromechanics.** Applied fluid mechanics with particular reference to topics in hydraulic design, analysis, and research in civil engineering areas; dimensional analysis and dynamic similarity, analysis of potential flow, boundary-layer problems, turbulence and diffusion, hydraulic transients, water waves, and transport phenomena. Prerequisite: Theoretical and Applied Mechanics 235 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
352. **Water Resources Design.** Study and evaluation of phases of river mechanics, water resources history and project implementation, and development of a water resources project plan. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
353. **Hydraulic Structures.** Introduction to the design of hydraulic structures; consideration of types and functions of dams; hydrologic design; hydraulic design of spillways and outlet works; determination of loads and stresses for concrete structures; and seepage, piping, and stability of earth structures. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
356. **Hydraulics of Surface Drainage.** Application of hydraulic and hydrologic principles; elements of channel design; hydrologic determination of design flow; flow through bridge openings and other obstacles; hydraulics of drainage areas; overland flow; runoff from highways, runways, and urbanized areas; hydraulics of storm-drain systems; and culvert design. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
359. **Dynamics of Aerosols and Hydrosols.** Same as Mechanical Engineering 303. Theory and application of the basic relations of fluid dynamics, thermodynamics, and heat transfer to the motion of aerosols and hydrosols, with application to problems in air and water pollution. Prerequisite: Senior or graduate standing. 3 hours or 1 unit.
361. **Matrix Analysis of Framed Structures.** A unified formulation of displacement and force methods of analysis including the topological view of the structure as an assemblage of members; matrix techniques of formulation; considerations for automatic computation; and evaluation of truss, grid, and frame models for the response of real structures. Prerequisite: Civil Engineering 262. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Behavior and Design of Metal Structures, II.** Metal members under combined loads; welded and riveted connections; moment-resistant connections; and plate girders and plastic design concepts. Prerequisite: Civil Engineering 263 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
364. **Reinforced Concrete Design, II.** Study of the strength, behavior, and design of indeterminate reinforced concrete structures, with primary emphasis on slab systems; em-

phasis on the strength of slabs and on the available methods of design of slabs spanning in two directions, with or without supporting beams. Prerequisite: Civil Engineering 262 and 264. 3 hours, or $\frac{3}{4}$ or 1 unit.

365. **Design of Structural Systems.** The whole structural design process including definition of functional requirements, selection of structural scheme, formulation of design criteria, preliminary and computer-aided proportioning, and analysis of response, cost, and value. Prerequisite: Civil Engineering 263 or 264, or equivalent. 3 hours or 1 unit.
368. **Prestressed Concrete.** Study of strength, behavior, and design of prestressed reinforced concrete members and structures, with primary emphasis on pretensioned, precast construction; emphasis on the necessary coordination between design and construction techniques in prestressing. Prerequisite: Civil Engineering 262 and 264. 3 hours, or $\frac{3}{4}$ or 1 unit.
369. **Behavior and Design of Wood Structures.** Mechanical properties of wood, stress grades and working stresses; effects of strength-reducing characteristics, moisture content, and duration of loading and causes of wood deterioration; glued-laminated timber and plywood; behavior and design of connections, beams, and beam-columns; design of buildings and bridges; other structural applications: trusses, rigid frames, arches, and pole-type buildings; and prismatic plates and hyperbolic paraboloids. Prerequisite: Civil Engineering 261 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
370. **Structural Reliability and Probabilistic Bases of Design.** Modern probabilistic bases for the design and evaluation of structures and systems, including analysis of structural safety and reliability, and development of probability-based design criteria; quantitative risk evaluation, systematic assessment and analysis of uncertainties, safety and load factor determinations, and risk analysis and design for wind storms and earthquakes. Prerequisite: Civil Engineering 261 and 293, or equivalent, or graduate standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
374. **Introduction to Structural Dynamics.** Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multidegree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility. Credit is not given for both Civil Engineering 374 and Theoretical and Applied Mechanics 311. Prerequisite: Theoretical and Applied Mechanics 212; Mathematics 345; Civil Engineering 261, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
375. **Welding and Joining Processes.** Same as Metallurgical Engineering 301. The physical principles of fusion welding; heat flow; thermal cycles; physical metallurgy and mechanical properties of welded joints; applications of welding to large structures; testing of welds; nondestructive testing; design, economics, and weld specifications; and laboratory experiments in welding. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
378. **Introduction to the Design of Ocean Structures.** Introduction to design and construction of civil engineering structures in the ocean and to associated engineering operations; principal topics include water wave mechanics, engineering oceanography, wave and current forces, and design considerations for fixed and floating structures. Prerequisite: Theoretical and Applied Mechanics 235; Civil Engineering 261; Civil Engineering 293. 3 hours, or $\frac{3}{4}$ or 1 unit.
379. **Applied Structural Mechanics.** Study of beams under lateral load; beams with combined lateral load and thrust; beams on elastic foundations; applications of Fourier series and virtual work principles to beam-type structures; stress and strain in three dimensions; applications to flexure of beams and plates; elements of the engineering theory of plates; and torsion of thin-walled open sections. Prerequisite: Mathematics 345 and Civil Engineering 262. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Soil Mechanics and Soil Properties.** Index properties and engineering classification; water flow and hydraulic properties; stress in soil; stress-strain properties of soils; consolidation; shear strength; properties of natural soil deposits; unsaturated soils; and ex-

perimental measurements. Prerequisite: Civil Engineering 280 or equivalent, or consent of instructor. 4 hours or 1 unit.

384. **Applied Soil Mechanics.** Application of soil mechanics to foundations of buildings; stability of earth slopes; earth pressures and retaining walls; braced cuts; and damage due to construction operations. Prerequisite: Civil Engineering 383 or equivalent. 4 hours or 1 unit.
385. **Terrain Analysis.** Use of geologic and pedologic information and airphoto interpretation techniques in the analysis of terrain for engineering purposes, correlations among physiographic regions, soil regions, and engineering problems. Field trip; estimated cost, \$5.00. Prerequisite: Civil Engineering 280 or equivalent. 4 hours or 1 unit.
391. **Computer Methods in Civil Engineering.** Review of programming concepts; formulation and programming of numerical, data processing, and logical problems with applications from various branches of civil engineering; organization of programs and data; and development and use of problem-oriented programming languages in civil engineering. Prerequisite: Computer Science 101 or equivalent; senior or graduate standing in civil engineering; or consent of instructor. 3 hours or 1 unit.
392. **Network Methods in Civil Engineering.** Application of network models to the planning, design, and analysis of civil engineering systems; network algebra; potential networks; flow networks and networks governed by constitutive equations; and logic and data networks. Prerequisite: Civil Engineering 292 or graduate standing, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
405. **Analytical Aerotriangulation.** Iterative and simultaneous rigorous block adjustment methods, and numerical methods for the solution of large systems of equations; characteristics of various analytical photogrammetric systems. Prerequisite: Civil Engineering 306 or consent of instructor. 1 unit.
416. **Design of Construction and Industrial Operations, I.** Same as Industrial Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues, and inventory models required for systems design; and design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering, or credit or concurrent registration in Mathematics 363, or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Industrial Engineering 417. Continuation of Civil Engineering 416. Prerequisite: Civil Engineering 416 or Industrial Engineering 416; credit or concurrent registration in Mathematics 315; or consent of instructor. 1 unit.
420. **System Approach to Pavement Design.** Concepts of system approach; pavement function and performance; evaluation of surface properties and relation to vehicle performance; analysis of subsystems and principal components; composition and properties of pavement mixtures; and durability problems and controls. Prerequisite: Civil Engineering 220 or 221, or equivalent. 1 unit.
421. **Pavement Design, II.** Structural design of flexible and rigid pavements; loading characteristics and static, impact and repeated loads; load distribution through pavement layers, factors affecting distribution, and methods of analysis; evaluation of subgrade support; and criteria for selecting design values. Prerequisite: Civil Engineering 220 or equivalent. 1 unit.
422. **Fundamental Properties and Behavior of Bituminous Mixtures.** Composition and theories of physical structure of bitumens; rheological, failure, durability, and adhesive properties of bitumens and bituminous mixtures; and analysis of factors influencing the performance of bituminous aggregate mixtures. Prerequisite: Civil Engineering 321 or consent of instructor. 1 unit.
423. **Highway Materials Stabilization.** Stabilization of aggregates and soils with cement, lime, bituminous materials, and other stabilizing agents; emphasis on basic stabilization reactions, properties of stabilized materials, and composition design. Prerequisite: Civil Engineering 220 or consent of instructor. 1 unit.

426. **Traffic Planning.** Traffic engineering planning functions; urban and rural master traffic plans; and traffic analyses for new or existing streets, highways, and terminal facilities. Prerequisite: Civil Engineering 325 or equivalent. 1 unit.
427. **Geometric Highway Design.** Highway classification; highway capacity; highway design controls; sight distance; horizontal and vertical alignment; cross-section elements; highway types; controlled access highways; and design of at-grade of intersections, grade separations, and interchanges. Prerequisite: Civil Engineering 325 and 426, or consent of instructor. 1 unit.
428. **Traffic Engineering Operations.** Theory of traffic control; laws and ordinances; design and application of traffic control devices; special street designations; parking design and control; street illumination; and miscellaneous traffic control designs. Prerequisite: Civil Engineering 325 and 426, or equivalent. 1 unit.
435. **Railway Construction and Maintenance.** Roadbed load capacity; economic design of track; advanced geometric design; economics of maintenance; grade crossing separations; and review of specific projects. Prerequisite: Civil Engineering 335. 1 unit.
436. **Railroad Location and Operation.** Track and traffic capacity; optimum train size, performance, and scheduling; validity and accuracy of current practices; regional operating factors; and optimum size of plant and modern location. Prerequisite: Civil Engineering 336 or consent of instructor. 1 unit.
440. **Water Treatment Processes.** Theory and basic design of the processes used in water treatment, including gas transfer, energy transfer, chemical precipitation, solids separation, disinfection, and solids disposal. Prerequisite: Credit or concurrent registration in Civil Engineering 340 and 343, or consent of instructor. 1 unit.
442. **Wastewater Treatment Processes.** Composition and properties of wastewaters; theoretical considerations and design criteria for wastewater treatment and renovation processes, including chemical, physical, aerobic, and anaerobic biological processes, waste sludge disposal, and advanced waste treatment processes. Prerequisite: Civil Engineering 340 and 343, and credit or concurrent registration in Civil Engineering 346, or consent of instructor. 1 unit.
443. **Unit Operations in Environmental Engineering.** Experimental and pilot plant studies of unit operations and unit processes in environmental engineering, emphasizing water treatment and wastewater treatment; evaluation of parameters for the design of biological waste treatment units; determination of chemical requirements for water treatment processes; and studies of anaerobic digestion. Prerequisite: Civil Engineering 440 or credit or concurrent registration in Civil Engineering 442, or consent of instructor. 1 unit.
444. **Treatment of Industrial Wastes.** Basic concepts in approaching and solving industrial waste problems; theory and application of unit operations unique to the treatment of industrial wastes; and advanced considerations of wastewater problems and solutions of major industries. Prerequisite: Credit or concurrent registration in Civil Engineering 442 or consent of instructor. $\frac{1}{2}$ or $\frac{3}{4}$ unit.
445. **Water Quality and Pollution.** Water quality standards and criteria for various beneficial uses; transport mechanisms for pollution in surface streams and ground water; and fate of pollution and pollution control. Prerequisite: Civil Engineering 250 and 251; Mathematics 345. 1 unit.
446. **Design of Water and Waste Treatment Plants.** Study of the fundamental factors affecting choice of treatment units and combination of unit processes into an integrated plant. Prerequisite: Civil Engineering 440 or credit or concurrent registration in Civil Engineering 442, or consent of instructor. 1 unit.
448. **Control of Air Pollution from Stationary Sources.** Same as Mechanical Engineering 411. Study of the basic theory of pollution control devices and their application to air pollution control problems. Prerequisite: Credit or concurrent registration in Civil Engineering 340 or 343, or consent of instructor. 1 unit.
449. **Analysis of Air Pollutants.** Same as Mechanical Engineering 412. Laboratory analysis

of common air pollutants; theory of operation of laboratory and automatic field instrumentation. Prerequisite: Civil Engineering 343 or consent of instructor. $\frac{3}{4}$ unit.

450. **Hydrologic Systems.** Application of systems concepts to simulate and analyze hydrologic cycle and its components in terms of various deterministic, probabilistic, stochastic, lumped, distributed, linear, and nonlinear mathematical models for the purpose of planning and designing water resources projects. Prerequisite: Civil Engineering 350 or consent of instructor. 1 unit.
452. **Water Resources.** An advanced interdisciplinary course on water resources planning and development; geographic aspects; data collection; governmental functions; hydrologic implications; river hydraulics; hydraulic physical units and water quality; economic aspects; legal, political, and social problems; and case studies. Prerequisite: Consent of instructor. 1 unit.
455. **Transport Processes in Water.** Physical processes in transport by water, with emphasis on transport of pollutants; turbulent diffusion and longitudinal dispersion in pipes, rivers, and estuaries; stream reaeration; ocean outfalls; waste heat disposal; and dispersion in groundwater. Prerequisite: Mathematics 343 and 345, and Theoretical and Applied Mechanics 235, or consent of instructor. $\frac{3}{4}$ or 1 unit.
457. **Ground Water.** An advanced interdisciplinary course on ground water; hydrogeology; hydrodynamics of flow through porous media; ground water hydrology; hydraulics of wells; hydraulic analysis of seepage; ground water pollution; and ground water resources. Prerequisite: Consent of instructor. 1 unit.
458. **Open-Channel Hydraulics.** Basic hydromechanics; flow types; channel characteristics; flow-profile computations; hydraulic jump analysis; design of nonerodible, erodible, and grassed channels and transitional structures; study of supercritical flow and unsteady flow; modern developments in theory and design practice; and application of numerical method, method of characteristics, method of singular point, and electronic digital computers and analogs. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
463. **Optimization of Structures.** Structural design processes; formulation of problems in the optimization of structures; optimization of structural elements; minimum volume principles; and use of mathematical programming in optimization of structural systems. Prerequisite: Bachelor of Science degree in engineering with courses in structural analysis and design, or consent of instructor. 1 unit.
465. **Behavior of Structural Steel Frameworks.** Theories of ultimate behavior of metal structural members with particular emphasis on buckling and stability of members and frames; interpretation of research findings and specifications for bridge and building design. Prerequisite: Civil Engineering 263. 1 unit.
466. **Behavior of Reinforced Concrete Members.** In-depth study of the behavior of reinforced concrete members, including the relationships between behavior and building code requirements. Prerequisite: Civil Engineering 262 and 264. 1 unit.
467. **Behavior of Reinforced Concrete Structures.** Study of the strength and behavior of assemblages of reinforced concrete members, including a study of the applicability of traditional elastic design procedures to structures which exhibit inelastic behavior under the influence of both short and long term loadings. Prerequisite: Civil Engineering 466. 1 unit.
469. **Thin Shell Structures.** Fundamental membrane and bending theories of shells; application of theories to analysis and design of folded plates and cylindrical, rotational, and translational shells; membrane stresses and deflections; and approximate bending solutions by variational, finite-difference, and finite-element methods. Prerequisite: Civil Engineering 473 or consent of instructor. 1 unit.
471. **Numerical and Approximate Methods of Structural Analysis.** Numerical and approximate analytical procedures for the solution of complex problems with applications to bridges, buildings, and aircraft structures; solution methods for discrete and continuous equilibrium problems and eigenvalue problems. Prerequisite: Civil Engineering 379 or equivalent. 1 unit.

473. **Theory of Plates.** Classical plate bending theory; emphasis on methods of solution including series expansions, variational procedures, and finite element techniques applicable to plate-type structures commonly encountered in practice; and consideration of inplane loads, large deflections, buckling, and anisotropy. Prerequisite: Civil Engineering 262 and Mathematics 345. 1 unit.
474. **Dynamics of Framed Structures.** Advanced treatment of the dynamics of multidegree-of-freedom framed structural systems; fundamental concepts of eigenvalue theory of real matrices and energy principles of dynamics as bases for a unified approach to dynamical problems of structural assemblages; structural idealizations, principles of dynamics, Lagrange's equations, response calculations, normal mode method and its limitations, and transfer matrix approach; and computer utilization. Prerequisite: Civil Engineering 361 and 374, or equivalent. 1 unit.
475. **Behavior of Steel Structures.** Critical evaluation of the actual behavior of metals, connections, members, and structures; the significance of this behavior in terms of design and the development of design specifications. This course and Civil Engineering 465 form a unit in the study of theoretical and experimental investigations. Prerequisite: Graduate standing in civil engineering or theoretical and applied mechanics. 1 unit.
476. **Plastic Analysis and Design.** Basic concepts of limit analysis; plastic hinge formation; development and analysis of collapse mechanisms; inelastic behavior of metal structural frameworks: strength and stability under combined loadings; deflections; incremental collapse, and shakedown under variable repeated loading; application of plastic design to high-rise braced and unbraced steel frames; introduction to optimum design; and basis for application. Prerequisite: Credit or concurrent registration in Civil Engineering 465, or consent of instructor. 1 unit.
478. **Finite Element Methods in Solid and Structural Mechanics.** Theory and application of the finite element method; stiffness matrices for triangular, quadrilateral, and isoparametric elements; two- and three-dimensional elements; algorithms necessary for the assembly and solution; direct stress and plate bending problems for static, nonlinear buckling and dynamic load conditions; and displacement, hybrid, and mixed models together with their origin in variational methods. Prerequisite: Theoretical and Applied Mechanics 451, or Civil Engineering 379, or consent of instructor. 1 unit.
479. **Earthquake Engineering.** Study of the effects of earthquakes on constructed works and of the design of structures to resist earthquake motions; earthquake ground motions and mechanisms; response of structures to earthquake motion; behavior of materials, elements, assemblages and structures subjected to earthquake motion; principles of earthquake resistant design; and special topics. Prerequisite: Civil Engineering 374. 1 unit.
480. **Earth Pressures and Retaining Structures.** Classical and modern earth pressure theories and their experimental justification; pressures and bases for design of retaining walls, bracing of open cuts, anchored bulkheads, cofferdams, tunnels, and culverts. Prerequisite: Credit or concurrent registration in Civil Engineering 384. 1 unit.
481. **Earth Dams and Related Problems.** Fundamentals of problems of slope stability; seepage in composite sections and anisotropic materials; methods of stability analysis; mechanism of failure of natural and artificial slopes; compaction; and field observations. Prerequisite: Credit or concurrent registration in Civil Engineering 384. 1 unit.
482. **Advanced Soil Mechanics, I.** Theoretical and experimental studies in soil mechanics; stress distribution in homogeneous and stratified soils; theory of consolidation for multidirectional flow and time-dependent loading; numerical methods; secondary consolidation; settlement analysis; and experimental measurements. Prerequisite: Civil Engineering 383. 1 unit.
483. **Advanced Soil Mechanics, II.** Theoretical and experimental studies in soil mechanics; shearing properties of saturated soils; physical properties of partially saturated soils; physicochemical properties of clays; and laboratory direct shear and triaxial shear testing. Prerequisite: Civil Engineering 383. 1 unit.

- 484. Foundation Engineering.** Critical study of case histories of projects in foundation engineering; current procedure for design and construction of foundations, embankments, and waterfront structures. Prerequisite: Civil Engineering 384. 1 unit.
- 485. Soil Engineering for Transportation Facilities.** Systems of soil classification; application of statistical methods to soil engineering; relation of mineralogy to engineering properties; soil water migration and volume change; soil structure and stabilization by compaction; soil freezing and pavement behavior; behavior under repeated loading; and stability of base embankments. Prerequisite: Civil Engineering 383 or equivalent. 1 unit.
- 486. Rock Mechanics, I.** Physical properties and classification of intact rock, theories of rock failure, state of stress in the earth's crust, stresses and deformations around underground openings assuming elastic, plastic, and time-dependent behavior; effect of geologic discontinuities on rock strength; and introduction to stability analyses in rock. Prerequisite: Civil Engineering 383; Geology 450 or equivalent; Theoretical and Applied Mechanics 321 or equivalent; or consent of instructor. 1 unit.
- 487. Rock Mechanics, II.** Application of rock mechanics to engineering problems; shear strength of rock masses; dynamic and static stability of rock slopes; deformability of rock masses; design of pressure tunnel linings and dam foundations; controlled blasting and blasting vibrations; tunnel support; machine tunneling; design and construction of large underground openings; and field instrumentation. Prerequisite: Civil Engineering 486 or consent of instructor. 1 unit.
- 494. Municipal Administration and Engineering.** Legal authority of municipalities, and forms of municipal government; municipal functions, organization, and management; city finance; engineering functions of city government; city planning and zoning; building codes and inspection; street lighting; public utilities; city cleaning; and recreational development. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
- 495. Civil and Environmental Engineering Seminar.** Discussion of current topics in civil and environmental engineering and related fields by staff, students, and visiting lecturers. 0 to $\frac{1}{4}$ unit. Course may be repeated.
- 497. Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by his adviser and the staff member who will supervise the investigation. Prerequisite: Consent of instructor. 0 to 4 units.
- 499. Thesis Research.** 0 to 4 units.

CLASSICS

(Including Classical Archaeology, Classical Civilization, Greek, Hebrew, and Latin)

Head of Department: Professor M. Marcovich

Department Office: 4072 Foreign Language Building, Urbana

Classical Archaeology

The following courses presuppose no knowledge of the Greek and Latin languages and are open to all students.

- 331. The Archaeology of Greece.** Monuments and material remains illustrating the development of Greek civilization to 323 B.C. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 332. The Archaeology of Italy.** Monuments and material remains illustrating the development of Graeco-Roman and other ancient Italian civilizations to 330 A.D. Prerequisite:

site: A course in ancient history, art, or language, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

335. **The Topography of Athens.** Survey of the topography, monuments, and architecture of ancient Athens. Prerequisite: Classical Archaeology 331 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **The Topography of Rome.** Survey of the topography, monuments, and architecture of ancient Rome. Prerequisite: Classical Archaeology 332 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
433. **The Archaeology of Magna Graecia and Sicily.** Problems in the archaeology of Magna Graecia and Sicily. Prerequisite: Classical Archaeology 331 and 332, or equivalent. 1 unit.
435. **Field Work.** Participation in archaeological excavation; discussion of methods and procedures and practice in actual working conditions. Prerequisite: Consent of instructor. 1 unit.

Classical Civilization

The following courses presuppose no knowledge of the Greek and Latin languages and are open to all students. For other courses in the area of classical civilization, see Architecture 211 and 310; Art and Design 217, 218, 301, 303, 304, and 305; Classical Archaeology 331, 332, 335, and 336; History 181, 182, 381, 382, 383, and 384; Philosophy 303, 309, and 310; Political Science 393; and Religious Studies 201, 202, 206, 210, 211, and 340.

100. **Vocabulary Building from Greek and Latin Roots.** Vocabulary building assistance for students through an analysis of Greek and Latin roots, prefixes, and suffixes found in English. 2 hours.
110. **Introduction to Greek Culture.** Study of social and cultural life in Greece during the classical period. 2 hours.
111. **Mythology of Greece and Rome.** Lectures and readings. 2 hours.
112. **The Roman Achievement.** Introduction to Roman civilization through the study of the social and cultural life of ancient Rome. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Greek Literature in Translation.** Introduction to Greek literature, from Homer to the Hellenistic age, and its cultural and historical background. 3 hours.
202. **Latin Literature in Translation.** Introduction to Latin literature of the classical period and to its cultural and historical background. 3 hours.
221. **The Heroic Tradition.** Study of ancient epics and their relation to the social consciousness of their period; introductory and background lectures; and readings in the epic tradition of antiquity and its successors. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
222. **The Tragic Spirit.** Readings in the tragic drama of Greece and Rome: a systematic study of the contents and development of this classical literary/dramatic genre. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
315. **Greek, Roman, and Medieval Rhetorical Theory.** Same as Speech Communication 315. Examination of the development of rhetorical theory, criticism, and pedagogy in Western thought; an analysis of the contribution of major figures and works from Homer to the Renaissance. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit. Graduate students registered for 1 unit will be expected to do additional work.
331. **Satire and Social Criticism.** Same as Comparative Literature 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in the Greek old comedy and Roman satire, or by suggesting escape, as in the new comedy of manners and the prose romances; some at-

tention to the tradition of satire in medieval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

332. **The Ancient Ideal in Art and Literature.** Study of the aesthetic standards and theories of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
341. **Topics in Classical Literature.** Study of selected topics in Greek and Latin literature in translation; content is variable. Prerequisite: Classical Civilization 201 or 202, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
342. **Aspects of Greek and Roman Civilization.** Study of selected aspects of Greek and Roman civilization by treating particular topics as they appear in both civilizations; content is variable. Prerequisite: Classical Civilization 110 and 112, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
347. **The Age of Charlemagne.** Same as History 347. The Age of Charlemagne and its intellectual, political, social, and cultural significance for Western civilization. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

Greek

101. **Elementary Greek.** Introduction to the fundamentals of classical Greek, including the reading of simple prose. No credit toward graduation is given for Greek 101 without Greek 102. 4 hours.
102. **Elementary Greek.** Continuation of Greek 101. Grammar and reading. Prerequisite: Greek 101 or equivalent. 4 hours.
111. **Elementary Koine Greek.** Same as Religious Studies 111. Introduction to the fundamentals of Koine Greek, including reading from the New Testament. No credit toward graduation is given for Greek 111 without Greek 112. 4 hours.
112. **Elementary Koine Greek.** Same as Religious Studies 112. Continuation of Greek 111. Grammar and reading. Prerequisite: Greek 111 or equivalent. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elementary Koine Greek.** Same as Religious Studies 200. Reading of narrative and epistolary New Testament Greek. Prerequisite: Greek 112 or equivalent. 4 hours.
201. **Second-Year Greek.** Reading of Attic prose. Prerequisite: Greek 102 or equivalent. 4 hours.
202. **Second-Year Greek.** Continuation of Greek 201. Introduction to epic Greek; reading of Homer. Prerequisite: Greek 201 or equivalent. 4 hours.
291. **Senior Thesis.** Open to candidates for distinction in Greek. Prerequisite: Senior standing. 2 or 4 hours.
293. **Senior Survey.** Thesis and honors. For candidates for honors in Greek and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
301. **Third-Year Greek.** Readings in Attic prose. Prerequisite: Greek 202. 3 hours or $\frac{1}{2}$ unit.
302. **Third-Year Greek.** Continuation of Greek 301. Readings in Greek tragedy. Prerequisite: Greek 301. 3 hours or $\frac{1}{2}$ unit.
308. **Comparative Grammar of Greek and Latin.** Same as Latin 308 and Linguistics 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or $\frac{3}{4}$ unit.
309. **The Structure of Greek.** Same as Latin 309 and Linguistics 311. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Greek 202 or Latin 202, or their equivalents with the option of simultaneous enrollment; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Greek Prose Composition.** Practice in the writing of Greek prose. Prerequisite: Greek 201 or equivalent. 3 hours or $\frac{3}{4}$ unit.

312. **Sight Translation.** Exercise in the sight translation of passages of Greek authors. Prerequisite: Greek 202 or equivalent. 3 hours or $\frac{3}{4}$ unit.
371. **The Gospels.** Same as Religious Studies 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
381. **Readings in Narrative Prose.** Readings chosen by the instructor from the following: Herodotus, Thucydides, Hellenica Oxyrhynchia, Polybius, and Plutarch's Lives. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
382. **Lyric Poetry.** Readings chosen by the instructor from the extant corpus of lyric, elegiac, iambic, and bucolic poetry. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Oratory.** Readings chosen by the instructor from one or more of the Attic orators or the orators of the Second Sophistic. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
384. **Epic Poetry.** Readings from one or more of the following: Homer, the Iliad, Hesiod, Works and Days, Homeric hymns, and Apollonius of Rhodes. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
385. **Philosophical Authors.** Readings from Plato, Aristotle, Xenophon's Memorabilia, or other philosophical texts. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Attic Drama.** Readings from Aeschylus, Sophocles, Aristophanes, or Menander. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
391. **Readings in Greek Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Greek. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated to a maximum of 12 hours.
409. **Greek Versification.** Greek prosody; survey of meters, lines, and cola in epic, lyric, and dramatic poetry and of lyric meters of Greek drama. 1 unit.
411. **Hellenistic Literature.** Prerequisite: Graduate standing and three years of college Greek. 1 unit.
413. **Greek Lyric Poetry.** Prerequisite: Three years of college Greek. 1 unit.
414. **Pindar.** Prerequisite: Adequate knowledge of Greek. 1 unit.
415. **Homer.** Prerequisite: Adequate knowledge of Greek. 1 unit.
416. **Thucydides.** Prerequisite: Three years of college Greek, or consent of instructor. 1 unit.
417. **Bacchylides.** Prerequisite: Adequate knowledge of Greek. 1 unit.
420. **Plato.** Prerequisite: Greek 391 or equivalent. 1 unit.
422. **Sophocles.** Prerequisite: Adequate knowledge of Greek.
423. **Aeschylus.** Prerequisite: Adequate knowledge of Greek. 1 unit.
424. **Euripides.** Prerequisite: Adequate knowledge of Greek. 1 unit.
425. **Greek Drama: Comedy.** Prerequisite: Adequate knowledge of Greek. 1 unit.
441. **Greek Palaeography.** History and development of Greek writing from the third century B.C. to the end of the fifteenth century A.D. Prerequisite: Greek 302 or equivalent. 1 unit.
460. **Studies in Patristic Greek Literature.** Aspects of the religious and social history of early Christianity on the basis of Greek Patristic texts. 1 unit.
480. **Seminar.** Required of majors in classical philology. Prerequisite: Advanced standing; completion of a 400-level proseminar. 1 unit.
493. **Independent Reading.** Individual readings from all areas of classical and later Greek literature selected in consultation with the instructor. May be repeated for credit, but no more than 1 unit of credit in this course may be applied toward the minimum requirements of the M.A. degree; no more than 2 units of credit can be applied toward the minimum requirements of the Ph.D. degree. Prerequisite: Consent of the student's adviser and of the instructor. $\frac{1}{2}$ to 2 units.
495. **Bibliography and Criticism.** Same as Latin 495. Introduction to the methods and techniques of scholarship. Prerequisite: Four years of college Latin or equivalent. $\frac{1}{2}$ unit.

496. **Bibliography and Criticism.** Same as Latin 496. Prerequisite: Four years of college Latin or equivalent. $\frac{1}{2}$ unit.
499. **Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

Hebrew

110. **Introduction to Biblical Hebrew.** Same as Religious Studies 108. Stress on mastery of grammar, reading, writing, and simple prose composition; reading of simple Biblical prose. 4 hours.
111. **Introduction to Biblical Hebrew.** Same as Religious Studies 109. Syntax and reading of simple classics' prose narrative. Prerequisite: Hebrew 110 or Religious Studies 108. 4 hours.
210. **Biblical Prose.** Same as Religious Studies 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Hebrew 110 and 111, or Religious Studies 108 and 109. 4 hours.
211. **Biblical Poetry.** Same as Religious Studies 211. Reading and discussion of the Book of Amos and of selections from the Psalms; exercises in prose composition. Prerequisite: Hebrew 210. 4 hours.

Latin

101. **Elementary Latin.** Grammar and reading for students who have had no work in Latin. No credit toward graduation is given for Latin 101 without Latin 102. 4 hours.
102. **Elementary Latin.** Grammar and reading of easy prose. Prerequisite: Latin 101 or one year of high school Latin. 4 hours.
103. **Intermediate Latin.** Review of grammar; reading of easy narrative prose. Prerequisite: Latin 102 or two years of high school Latin. 4 hours.
104. **Introduction to Latin Literature.** Continuation of Latin 103, with readings chiefly in Latin poetic literature. 4 hours.
113. **Latin Composition.** Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Credit or concurrent registration in Latin 103 or three years of high school Latin. 2 hours.
114. **Latin Composition.** Continuation of Latin 113. Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Latin 113. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Survey of Latin Literature.** The republican period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
202. **Survey of Latin Literature.** The imperial period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
203. **Cicero and the Roman Republic.** Study of the political writings of Cicero, emphasizing the events of his consular year. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
204. **Vergil and the Augustan Age.** Study of the poetry of Vergil emphasizing the ancient epic as a literary genre and as the historical background to the Aeneid. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
280. **Teachers' Course.** Introduction to the problems of the teaching of Latin and a study of textbooks. Required of teacher-training majors in Latin. This course will not meet during the six-week student teaching period. Prerequisite: Latin 202; senior standing. 4 hours.
291. **Senior Thesis.** Thesis and honors. For candidates for honors in Latin and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
293. **Senior Survey.** Thesis and honors. For candidates for honors in Latin and for other seniors. 2 or 4 hours.

308. **Comparative Grammar of Greek and Latin.** Same as Linguistics 308 and Greek 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or $\frac{3}{4}$ unit.
309. **The Structure of Greek and Latin.** Same as Greek 309 and Linguistics 311. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Greek 202 or Latin 202, or their equivalents with the option of simultaneous enrollment; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Intermediate Prose Composition.** Practice in the writing of Latin prose. Prerequisite: Latin 114 or equivalent. 3 hours or $\frac{3}{4}$ unit.
312. **Advanced Composition.** Practice in the writing of Latin prose and verse. Prerequisite: Latin 311 or equivalent. 3 hours or $\frac{3}{4}$ unit.
313. **Oral Latin.** Introduction to the use of Latin as a means of oral communication, with particular reference to instruction in secondary schools. Prerequisite: Latin 312 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
360. **Patristic Latin.** Same as Religious Studies 360. Literary and historical texts in prose and poetry from Tertullian to Jerome and Augustine. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
361. **Medieval Latin.** Literary and historical texts in prose and poetry from Cassiodorus to Roger Bacon. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
381. **Roman Comedy.** Selections from the plays of Plautus and Terence. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
382. **Latin Lyric Poetry.** Selections from the poems of Catullus and Horace. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Roman Philosophical Authors.** Selections from Lucretius and from the essays of Cicero. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
384. **Roman Historians.** Selections from Caesar, Livy, and Tacitus. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
385. **Roman Epistolography.** Selections from the epistolary prose of Cicero, Seneca, and Pliny. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Latin Elegy.** Readings in Ovid, Propertius, and Tibullus. Prerequisite: Latin 204 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
391. **Readings in Latin Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Latin. Prerequisite: Three years of college Latin or equivalent; consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated to a maximum of 12 hours.
400. **Beginning Latin for Graduate Students.** Basic grammar, syntax, and vocabulary; reading practice. Designed for graduate students who need to use Latin in their research. 0 credit.
401. **Readings in Latin for Graduate Students.** Directed readings, largely in medieval and modern Latin. Designed for graduate students who need to use Latin in their research. Prerequisite: Latin 400 or two years of high school Latin, or equivalent. 0 credit.
402. **Teaching College Latin.** Designed for new graduate teaching assistants in the Classics Department; examination of new techniques for teaching pronunciation, vocabulary, grammar, and the reading of Latin; closely correlated with the teaching assignments of the graduate students. $\frac{1}{4}$ unit.
409. **History of the Latin Language.** Prerequisite: Two years of college Latin or equivalent; two years of modern foreign language. 1 unit.
410. **Vulgar Latin.** Prerequisite: Two years of college Latin; two years of a Romance language. 1 unit.
411. **Latin Epigraphy.** Study of inscriptions as documents illustrating the evolution of the Latin language, and as records of the customs, beliefs, and ideals of the common people of Rome and the provinces. Prerequisite: Three years of college Latin or equivalent; one year of ancient history. 1 unit.

412. **Latin Elegy.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
413. **Caesar.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
414. **Lucan.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
415. **Lucretius.** Study of the text, the meaning, and the sources of *De Rerum Natura*. Prerequisite: Four years of college Latin or equivalent. 1 unit.
416. **Vergil.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
421. **Horace.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
422. **Plautus and Terence.** Prerequisite: Four years of Latin or equivalent. 1 unit.
423. **Latin Romance.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
425. **Cicero.** Study of Cicero's life and literary activities. Prerequisite: Four years of college Latin or equivalent. 1 unit.
426. **Tacitus. The Annales.** Prerequisite: Four years of college Latin or equivalent. 1 unit.
427. **Roman Satire.** Prerequisite: Four years of Latin or equivalent. 1 unit.
441. **Latin Palaeography.** Evolution of the Latin script, with practice in classifying and reading capital, uncial, and minuscule hands. Prerequisite: Four years of Latin or equivalent. 1 unit.
460. **Bibliography and Criticism of Medieval Latin.** Introduction to research in medieval and patristic Latin. Prerequisite: Latin 360 or 361, or equivalent. $\frac{3}{4}$ or 1 unit.
461. **The Medieval Latin Bible.** Study of the Vulgate and earlier Latin versions of the Bible and of the commentaries of the Latin Fathers. Prerequisite: Latin 360 or 361, or equivalent. 1 unit.
462. **The Carolingian Renaissance.** Same as Comparative Literature 454. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. Prerequisite: Latin 360 or 361, or equivalent. 1 unit.
480. **Seminar.** Required of majors in classical philology. Prerequisite: Advanced standing; completion of a 400-level proseminar. 1 unit.
493. **Independent Reading.** Individual readings, selected in consultation with the instructor, from all areas of classical and later Latin literature. May be repeated for credit; no more than 1 unit of credit can be applied toward the minimum requirements of the M.A. degree; and no more than 2 units of credit can be applied toward the minimum requirements of the Ph.D. degree. Prerequisite: Consent of the student's adviser and of the instructor. $\frac{1}{4}$ to 2 units.
495. **Bibliography and Criticism.** Same as Greek 495. Introduction to the methods and techniques of scholarship. Prerequisite: Four years of college Latin or equivalent. $\frac{1}{2}$ unit.
496. **Bibliography and Criticism.** Same as Greek 496. Prerequisite: Four years of college Latin or equivalent. $\frac{1}{2}$ unit.
499. **Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

COMMUNICATIONS

Chairman of Committee on Graduate Study: Professor J. W. Carey
Office: 1207 West Oregon Street, Urbana

217. **History of Communications.** Same as Journalism 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; and communications in the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
218. **Communications and Public Opinion.** Same as Journalism 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.

220. **Processes and Systems of Communications.** Same as Journalism 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communication. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
231. **Mass Communications in a Democratic Society.** Same as Journalism 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
241. **Law and Communications.** Same as Journalism 241. Historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Journalism 251 and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
307. **The Art of the Screen: Narration.** Same as Speech Communication 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Speech Communication 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Communications 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or $\frac{1}{2}$ or 1 unit.
319. **Russian and East European Cinema.** Same as Humanities, Slavic, and Speech 319. Artistic, literary, and social aspects of cinematic history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or $\frac{3}{4}$ unit.
325. **Introduction to Psycholinguistics.** Same as Linguistics 325. Introductory survey of psychological and linguistic approaches to the study of communication. Credit is not given for both Psychology 325 and Communications 325. Prerequisite: Credit or concurrent registration in Linguistics 300. 3 hours or 1 unit.
335. **Interpersonal Communication Processes.** Same as Speech Communication 335. Study of the major processes involved in an individual's everyday life; emphasis on the development of interpersonal competency and orientations, social perception, interpersonal sentiment and hostility, trust, and the social context as factors influencing the understanding and evaluation of interpersonal messages. 3 hours, or $\frac{1}{2}$ or 1 unit. Graduate students registered for 1 unit will be expected to do additional work.
352. **Attitude Theory and Change.** Same as Psychology 352 and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201, or a comparable course of introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Language, Culture, and Society.** Same as Anthropology 370 and Linguistics 370. Examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, one course in communications or linguistics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

377. **International Communications.** Same as Political Science 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; and government-industry relations in communications. 3 hours or 1 unit.
414. **Seminar on Social Interaction.** Same as Sociology 414. Analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas; presentation of problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
417. **Contemporary Viewpoints in Speech Communication Theory.** Same as Speech Communication 417. A readings seminar comparing the principal approaches to communication and rhetorical theory in the twentieth century along with a consideration of their philosophical assumptions. 1 unit.
420. **Seminar in Semantics.** Same as Philosophy 420. Intensive study of important contemporary contributions in the fields of semantics, analytic philosophy, and the philosophy of language. Prerequisite: Graduate standing in philosophy or equivalent. 1 unit. May be repeated for credit.
424. **Developmental Psycholinguistics.** Same as Linguistics 424 and Psychology 424. Advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Linguistics 425 and Psychology 425. Critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic, information-theory, and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Linguistics 425 and Psychology 425. Critical discussion of research problems applied to psycholinguistic theories and techniques. Students taking this course plan, execute, and report an original piece of research in this area. Prerequisite: Communications 425; consent of instructor. ½ or 1 unit.
432. **Books and Libraries Since the Renaissance.** Same as Library Science 432. Study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
437. **The Analysis of Interpersonal Interaction.** Same as Speech Communication 437. Exploration of theory, methodology, and empirical findings of descriptive and experimental approaches to the analysis of verbal and nonverbal interaction processes in both laboratory and naturalistic settings. Prerequisite: Communications 335 or consent of instructor. 1 unit.
444. **Seminar in Public Opinion.** Same as Sociology 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; and mass media and public opinion. 1 unit.
456. **Attitude Measurement and Behavioral Prediction.** Same as Psychology 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction; emphasis on the attitude concept and the validity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.
462. **Seminar in Radio and Television.** Same as Radio and Television 462. Study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
463. **World Broadcasting.** Same as Radio and Television 463. Study of the broadcast systems used by the nations of the world; alternative and mixed systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other coun-

tries; implications of such new developments as satellites; and mass and nonmass uses. Prerequisite: Radio and Television 462 or consent of instructor. 1 unit.

468. **The Political Economy of Communications.** Same as Journalism 468. Analysis of the structure, policy, and behavior of such media of communications as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film, with special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
470. **Communications and Popular Culture.** Same as Journalism 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
471. **Proseminar in Communications, I.** Same as Journalism 471. General discussion of the mass media of communications, their role as social institutions, and their control and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
472. **Proseminar in Communications, II.** Same as Journalism 472. General discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
473. **History and Theory of Freedom of the Press.** Same as Journalism 473. Development of the Anglo-American press system and the idea of freedom of the press; contemporary mass media and their implications for freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
474. **Communications Systems.** Same as Journalism 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. Prerequisite: Consent of College of Communications. 1 unit.
481. **Economic and Social Aspects of Advertising.** Same as Advertising 481. Examination of advertising as an institution; the economic, social, and legal aspects of advertising with focus on current problems. Graduate credit is not given for both Communications 481 and Advertising 388. 1 unit.
482. **Research Methods in Advertising and Communications.** Same as Advertising 482. Treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications, and an examination of both nonquantitative and quantitative methods. Prerequisite: A basic course in statistical methods; consent of department. 1 unit.
485. **Advertising Planning and Decision Making.** Same as Advertising 485. Examination of the theoretical foundations of decision theory as related to planning and decision making in advertising; use of decision models in the development of strategies and tactics. 1 unit.
490. **Special Topics in Communications.** Prerequisite: Consent of chairman of committee on graduate study in communications. 1/2 to 2 units.
492. **Research Methods in Communications.** Same as Journalism 492. Introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication, with emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
499. **Thesis Research.** Prerequisite: Consent of chairman of committee on graduate study in communications, and of thesis supervisor. 0 to 4 units. Students may reregister for a total of 8 units.

COMPARATIVE LITERATURE

Director of Graduate Program: Professor H. Knust

Office: 2070 Foreign Languages Building, Urbana

203. **Goethe in Translation.** Same as German 203. Introduction to the life and works of Johann Wolfgang Goethe; focus on his poetic work and also on treatment of his major contributions to science as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as German 204. German medieval precourtly and courtly literature in translation; readings in the works of Hartmann, Gottfried, Wolfram, Walther, and others, including the following epics: Nibelungenlied, Gregorius, Tristan, Parzival. 3 hours.
313. **The Divine Comedy.** Same as Italian 313. Interpretation of Dante's Divine Comedy with special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or $\frac{1}{2}$ unit.
331. **Satire and Social Criticism.** Same as Classical Civilization 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in Greek old comedy and Roman satire, or by suggesting escape, as in the new comedy of manners and the prose romances; some attention to the tradition of satire in medieval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
359. **The International Folk Tale.** Same as English 367. Study of the origin, distribution, and nature of the folk tale. 3 hours or $\frac{3}{4}$ unit.
363. **Introduction to Comparative Literature, I.** Same as Humanities 363. One-year course in two parts, offering a survey of methods and goals of comparative literature illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or $\frac{3}{4}$ unit.
364. **Introduction to Comparative Literature, II.** Same as Humanities 364. Continuation of Comparative Literature 363. 3 hours or $\frac{3}{4}$ unit.
370. **Vladimir Nabokov.** Same as Russian 370 and English 370. The major contribution of Vladimir Nabokov to world literature. No knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
394. **Introduction to Methodology of Myth and Folklore.** Same as English 387, German 394, Slavic 394, and Speech 346. Prerequisite: One year of college literature, or consent of instructor; reading knowledge of one modern foreign language recommended. 3 hours or $\frac{3}{4}$ unit.
401. **Theory of Literature.** Methods and objectives of the discipline of comparative literature. Prerequisite: Reading knowledge of two foreign languages; consent of instructor. 1 unit.
415. **Dostoevsky.** Same as Russian 415. Dostoevsky: historical background, textual analysis, structure, philosophy, artistic evaluation, and influence on French, English, American, and German literatures. 1 unit.
419. **Tolstoy.** Same as Russian 419. Tolstoy: historical background, textual analysis, structure, philosophy, aesthetic evaluation, and influence on French, English, American and German literatures. Prerequisite: Graduate standing. 1 unit.
420. **Chekhov.** Same as Russian 420. Chekhov: historical background, textual analysis, structure, philosophy, artistic evaluation, and interrelationship with English, French, German (and Scandinavian), and American literatures. 1 unit.
431. **Comparative Slavic Literature.** Same as Slavic 431. Survey of Slavic literature, especially Czech, Polish, and Yugoslav, and their connection with Russian and Western traditions. 1 unit.
441. **Naturalism, Symbolism, Expressionism.** Same as German 451. German literature from the 1880s to the 1920s. 1 unit.
451. **Seminar in Literary Movements and Periods.** Investigation of the development and mutation of literary movements (classicism, romanticism, symbolism, etc.) through a

- study of critical texts and their reception in various countries. The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.
452. **Seminar in Romantic Literature.** Same as English 433. Devoted entirely to an aspect of romantic studies. Prerequisite: Consent of instructor. 1 unit. May be repeated as topic varies.
454. **The Carolingian Renaissance.** Same as Latin 462. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. Prerequisite: Latin 360 or 361, or equivalent. 1 unit.
461. **Seminar in Literary Genres and Forms.** Study of a form (the lyric, the novel, the drama, etc.) to discover its essential components in all the literatures studied and the significance of national variations. The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.
462. **Seminar in Spanish-American Novel.** Same as Spanish 436. Special problems in methodology and research, including other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit.
471. **Seminar in Literary Relations.** Investigation of the impact of one literature upon another, or of some specific works upon others (the role of English literature in continental Europe, the influence of Russian novelists on French and German writers, etc.). The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.
472. **Studies in French and Comparative Cinema.** Same as French 452. Historical, aesthetic, social, and technical studies of the French cinema and its development and relation to world cinema and to literature. 1 unit.
473. **Seminar in French and Comparative Cinema.** Same as French 482. Study of several major French directors within the context of French and international cinema; comparison with selected non-French directors; and the relationship of films to other literary forms. 1 unit.
478. **Seminar in Twentieth-Century French Literature.** Same as French 478. Discussion and research on some specialized topic in twentieth-century French literature. Topic announced in advance. 1 unit. May be repeated for credit.
481. **Seminar in Literary Themes and Types.** Study of a theme or type (the Faust myth, the romantic hero, etc.) to discover its essential components in all the literatures studied and the significance of national variations. The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.
482. **Seminar in Modern German Literature.** Same as German 461. Prerequisite: German 411 and 495. 1 unit.
493. **Special Studies.** $\frac{1}{4}$ to 1 unit.
499. **Thesis Research.** Intended for students engaged in writing a thesis as a partial requirement for the A.M. or Ph.D. degree in comparative literature. Maximum credit for master's candidates is 2 units. 0 to 4 units.

COMPUTER SCIENCE

Head of Department: Professor J. N. Snyder

Department Office: 252 Digital Computer Laboratory, Urbana

101. **Introduction to Automatic Digital Computing.** Introduction to machine organization, problem formulation, automatic programming, numerical analysis, machine language programming, and applications of computers; use of the computing facilities of the department for solving problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. 3 hours.

- 103. Introduction to Social and Behavioral Science Digital Computer Programming.** Introduction to computer programming for students with an interest in behavioral and social science computation; instruction in programming languages (FORTRAN and PL/I) with an emphasis on applications from statistical and data manipulative procedures. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. Prerequisite: Sophomore standing; one year of college mathematics or statistics. 3 hours.
- 105. Introduction to Computers and Their Application to Business and Commerce.** Introduction to computer fundamentals, higher language programming, and the use of the computer for the solution of business problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. 3 hours.
- 106. Introduction to Computers for Teachers.** Same as Secondary Education 106. Introduction to the principles of computer operation and programming, and their applications to education; use of computers to solve problems. Credit may be received for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. 3 hours.
- 107. Introduction to Computers for Secondary School Teachers of Mathematics.** Introduction to principles of digital computer operation, programming in machine and higher level languages, and applications; intended to make teachers aware of the possibilities that computers have in education in the mathematical sciences; and use of computers to solve problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 106, 107 or 121. Prerequisite: One year of college calculus. 3 hours.
- 109. Honors Course in Computer Science.** All students in a mathematics honors course or all students whose grades in mathematics within the past year were A are admitted to course without examination; others are admitted upon passing a special examination administered by the department. Enrollment is strictly limited to students with superior talents in computer science. Prerequisite: Registration in Computer Science 101, 103, 105, 107, or 121. 1 hour.
- 121. Introduction to Computer Programming.** The beginning course for students in the mathematics and computer science curriculum, and for other interested students; covers topics in digital computer organization, problem formulation, programming languages, and the solution of numerical and nonnumerical problems. Students write several programs to find solutions to problems using digital computers. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. 4 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 201. Machine Language and System Programming, I.** Principles of machine language programming; organization of computers and its effect on computer software; and interpretation and assembly language translation. Prerequisite: Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours.
- 209. Honors Course in Computer Science.** Prerequisite: Concurrent registration in Computer Science 201 or 264; consent of instructor. 1 hour.
- 211. Advanced Computer Programming.** Advanced features of programming languages; input/output discs and tapes; plotted output; and use of operating systems and job control languages. This course is intended primarily for students who are not majoring in computer science. Prerequisite: Computer Science 101, 103, 105, 106, or 107, or consent of instructor. 3 hours.
- 264. Introduction to the Structure and Logic of Digital Computers.** Introduction to the internal structure of digital computers; design of gates, flipflops, registers, and memories to perform operations on numerical and other data represented in binary form; and presentation in terms of logic devices (black boxes), not electrical circuits. Prerequisite: Computer Science 121 or equivalent is required; credit or concurrent registration in Computer Science 201 recommended. 3 hours.

287. **Introduction to Numerical Analysis.** Same as Mathematics 287. Presents basic, introductory material and concepts. Topics include computer representation of numbers; error analysis; iterative methods; solution of linear equations; and extensive use of the computer. A project is assigned. Prerequisite: One year of calculus; Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours.
290. **Individual Study.** Prerequisite: Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 1 or 2 hours.
293. **Introduction to Computer Hardware.** Introduction to computer devices and circuits for logic and memory. Lecture and demonstrations. Prerequisite: Mathematics 142 or 143, and Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours.
297. **Special Topics in Computer Science.** A lecture course in topics of current interest. Subjects are announced in the Timetable. Prerequisite: Consent of instructor. 2 to 4 hours.
301. **Formal Theory of Languages.** Introduction to mathematical models of programming languages and computation on a digital computer; phase structure languages, particularly context-free languages, and their syntactic analysis with application to translation; abstract models of digital computers and the computations which they can perform subject to various restrictions on control, memory, and time; and unsolvability results for computations and languages. Prerequisite: Computer Science 201, and senior standing or consent of instructor. 3 hours or 1 unit.
306. **Systems Programming.** Discussion of the organization and structure of operating systems for various modes of computer use from simple batch systems to time-sharing/multiprocessing systems. Prerequisite: Computer Science 201. 3 hours or 1 unit.
310. **Information Structures.** Lists, trees, and graphs; storage allocation; programming languages for manipulation of structures; and applications of structures in text editing, syntactic analysis, graphic display, file structures, and information storage and retrieval. Prerequisite: Computer Science 201 or consent of instructor. 3 hours or 1 unit.
311. **Information Systems.** Organization of automatic systems for the recognition and retrieval of information; data base description, and pattern recognition; computer-aided diagnosis; and an introduction to formal cognitive systems (specifically to artificial intelligence and heuristic programming). Prerequisite: Computer Science 310. 3 hours or 1 unit.
313. **Combinatorial Mathematics.** Same as Mathematics 313. Permutations and combinations; generating functions, recurrence relations; inclusion and exclusion; Polya's theory of counting; and block designs. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
357. **Computer-Assisted Instruction.** Same as Secondary and Continuing Education 357. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons; and treatment of instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Any Computer Science 100-level programming course, or consent of instructor. 4 hours or 1 unit.
365. **Digital Computer Methods for Statistical Data Processing.** Same as Agronomy 365. Study of methods for efficient utilization of high-speed equipment in the processing of statistical data; emphasis on principles of application of computing equipment to the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: A course in statistics or statistical methods, or equivalent, and any Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
367. **Computer Application to Problems in Mathematics.** Same as Mathematics 367. Discussion of many problems which can be formulated mathematically and lend themselves to computer solution. Problems are chosen from the following major areas: ap-

plied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; and game playing and decision problems. Prerequisite: Junior standing; Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.

373. **Combinatorial Computing.** Same as Mathematics 373. Computational aspects of algorithms for solving combinatorial problems; counting and enumeration, sorting, searching, and computational problems in graph theory and algebra. Prerequisite: Mathematics 315 or equivalent, and Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
375. **Automata and Formal Languages, I.** Same as Mathematics 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; and Post's correspondence problem and its application to context-free languages. Prerequisite: Computer Science 319 or consent of instructor. 3 hours or 1 unit.
376. **Automata and Formal Languages, II.** Continuation of topics in Computer Science 375. Context-sensitive languages and linear bounded automata; operations on languages, closure properties, and abstract families of languages; miscellaneous unsolvable problems; time-and tape-bounded Turing machines; and other topics chosen by the instructor. Prerequisite: Computer Science 375. 3 hours or 1 unit.
379. **Numerical Analysis, I.** Same as Mathematics 379. A careful study of solutions of non-linear equations, numerical integration, interpolation, and approximation; selected algorithms developed for numerical solution on computers. Prerequisite: Mathematics 343 or Computer Science 287, or consent of instructor. 3 hours or 1 unit.
380. **Numerical Analysis, II.** Same as Mathematics 380. Algorithms for and the theory of the numerical solution of initial value and boundary value problems for differential equations are covered. This material will lead to a discussion of numerical methods for linear algebra and eigenvalue problems. Prerequisite: Computer Science 287 or Mathematics 287; Mathematics 343. 3 hours or 1 unit.
383. **Linear Programming.** Same as Mathematics 383. Systems of linear inequalities, the standard canonical and general linear problems, and simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
385. **Theory of Semiconductor Computer Devices.** Same as Electrical Engineering 385. Crystal conduction; large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology: masking, oxidizing, and etching; and emphasis on development of device-theoretical background for computer logic design. Prerequisite: Computer Science 264 and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
389. **Digital Computer Circuit Design.** Same as Electrical Engineering 389. Design of switching circuits and systems, taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data handling links; and consideration of component tolerance, circuit reliability, and cost factors. Prerequisite: Computer Science 264 or Electrical Engineering 290 and either Computer Science 281 or Electrical Engineering 340. 3 hours or 1 unit.
391. **Switching Theory.** Same as Electrical Engineering 391 and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Mathematics 392 and Electrical Engineering 392. Synchronous machines; state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines; and hazards and interacting machines. Prerequisite: Mathematics, Electrical Engineering, or Computer Science 391. 3 hours or 1 unit.

394. **Introduction to Computer Arithmetic.** Same as Electrical Engineering 394. Review of binary number representations, logical design of adders and arithmetic units, and simple multiplication and division methods; multiplier recoding; redundant division methods; design of carry-save adders and signed-digit arithmetic units; and case studies of high-speed arithmetic units. Prerequisite: Computer Science 264. 3 hours or 1 unit.
395. **Control Structure of Computers.** Same as Electrical Engineering 395. Asynchronous, synchronous, and microprogrammed control structures in the framework of computer architecture; interlocking of autonomous subcontrols; and case studies in typical control features: instruction look-ahead, multiprocessing interrupt, and input/output. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 391 or Computer Science 201, or consent of instructor. 3 hours or 1 unit.
397. **Special Topics in Computer Science.** Lectures in topics of current interest. Subjects are announced in the Timetable. Prerequisite: Consent of instructor. 2 to 3 hours, or $\frac{1}{2}$ to 1 unit.
400. **Introduction to Automatic Digital Computing for Graduate Students.** Beginning course covering the programming of digital computers using procedure-oriented language. No graduate credit allowed. 1 hour.
401. **Compiler Construction.** Compiler structure; lexical analysis, syntax analysis, grammars, description of programming languages, automatically constructed recognizers, and error recovery; and semantic analysis, semantic languages, semantic processes, intermediate language, optimization techniques, and extendible compilers. Prerequisite: Computer Science 301 and 310. 1 unit.
413. **Computer Applications in Social Science Statistical Research.** Same as Psychology 413 and Sociology 413. Computer procedures for the analysis of sociological and psychological data, including probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387. 1 unit.
414. **Engineering Applications of Linear Graphs.** Same as Electrical Engineering 414. Elementary theory of linear graphs and Euler graphs; incidence, cut-set, and circuit matrices and their properties; realizability of cut-set, circuit, and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; and communication networks. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318. 1 unit.
441. **Computer Systems Analysis.** Development of analytical tools for modeling and analysis of real time computer systems; techniques include queueing theory, scheduling theory, and operations research methods. Prerequisite: Mathematics 361 or 363, or equivalent. 1 unit.
443. **Linear and Integer Programming.** Discussion of mathematical programming algorithms which are widely used along with their software packages and computational efficiencies; a self-contained discussion of linear programming; and discussion of the various algorithms of integer programming. Prerequisite: Mathematics 315 or equivalent. 1 unit.
444. **Introduction to Artificial Intelligence.** Same as Electrical Engineering 444. Introduction to basic concepts in artificial intelligence with emphasis on computer understanding of natural language concepts; data structure and list processing; linguistic analysis including both syntactic and semantic processing; automatic logic deduction and theorem proving; and survey of applications to systems including question answering, information retrieval, and problem solving. Prerequisite: Consent of instructor. 1 unit.
445. **Systems Modeling and Simulation.** Same as Business Administration 445. Theory and techniques of simulation and gaming; simulation languages such as GPSS, DYNAMO, and SIMSCRIPT. Applications: investigation, control, and design of various systems (inventory, production scheduling, computer, marketing, and others). Prerequisite: Computer Science 105 Mathematics 363, or Business Administration 374, or equivalent, or consent of instructor. 1 unit.

- 456. Coding Theory.** Same as Electrical Engineering 456. General discussion on coding theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; and applications to computers and data transmission systems. Prerequisite: Mathematics 317 or equivalent, or consent of instructor. 1 unit.
- 457. Advanced Numerical Analysis.** Same as Mathematics 457. Ordinary differential equations; existence theory of Picard, one-step and multistep methods, discretization error, convergence, stability, and boundary value problems; and integral equations. Prerequisite: Computer Science 380 or Mathematics 380, or consent of instructor. 1 unit.
- 458. Topics in Numerical Analysis.** Same as Mathematics 458. The numerical solution of initial and boundary value problems for partial differential equations; topics include the approximation of differential operators by difference operators, the solution of large systems of linear equations by iterative methods, and discussion of convergence and numerical stability. Prerequisite: Consent of instructor. 1 unit. May be repeated.
- 463. Information Theory.** Same as Electrical Engineering 463 and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361 or equivalent. 1 unit.
- 465. Topics in Automata Theory.** Same as Electrical Engineering 465 and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 392, or consent of instructor. 1 unit.
- 482. Theory of Digital Computer Arithmetic.** Same as Electrical Engineering 482. Emphasizes the use of redundancy in the representation of digits in order to increase the efficiency of computer arithmetic; topics include multiplier recoding, division with redundantly represented quotients, and structural redundancy as implied by carry-save and signed-digit techniques. Prerequisite: Computer Science 394 or Electrical Engineering 394. 1 unit.
- 485. Advanced Theory of Magnetic and Optic Computer Memory Devices.** Same as Electrical Engineering 485. Theory of ferromagnetism and superconductivity applied to memory devices; light propagation in anisotropic media; modulators and deflectors; and principles of laser operation. Prerequisite: Computer Science 385 or Electrical Engineering 385. 1 unit.
- 487. Theory of Approximation.** Same as Mathematics 487. General approximation theory in normed linear spaces with primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Chebyshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants as approximants; and use of approximations in computing. Prerequisite: Mathematics 318 or 348, or consent of instructor. 1 unit.
- 489. Topics in Analysis of Algorithms.** Theoretical analysis of various algorithms; topics include sorting, searching, selection, polynomial evaluation, matrix multiplication, and multiplication of real numbers. Prerequisite: Computer Science 389 or Mathematics 389, or equivalent, or consent of instructor. 3 hours or 1 unit.
- 490. Individual Study.** Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
- 491. Seminar in Computer Science.** Seminar on topics of current interest. Subjects are announced in the Timetable.
- 497. Special Topics in Computer Science.** Lecture course in topics of current interest. Subjects are announced in the Timetable. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
- 499. Thesis Research.** Section A, for master's degree candidates; Section B, for doctoral degree candidates. Prerequisite: Consent of instructor. 0 to 4 units.

CZECH

(See Slavic Languages and Literatures)

DAIRY SCIENCE

Head of Department: Professor K. E. Harshbarger

Department Office: 315 Animal Sciences Laboratory, Urbana

100. **Introduction to Dairy Production.** Survey of industry; breeds of cattle; and selection, feeding, and management of herds. Lecture, quiz, and laboratory. 3 hours.
110. **Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Horticulture 110. Principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101, and Zoology 104. 3 hours.
201. **Livestock Management.** Same as Animal Science 201. Principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Dairy science and animal science majors do not receive credit for this course. Prerequisite: Dairy Science 221 or Animal Science 325. 5 hours.
204. **Dairy Cattle Evaluation.** Relation of functional conformation, records, ancestry, age, environment, and individual traits as criteria which affect merit for milk production, breeding stock, and breeder acceptance. Prerequisite: Dairy Science 100 or consent of instructor. 3 hours.
205. **Dairy Cattle Management.** Applied aspects of feeding, breeding, care, and management as they relate to the effective operation of a dairy farm enterprise. 3 hours.
221. **Animal Nutrition.** Same as Animal Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Dairy Science 221 and Animal Science 325. Prerequisite: Chemistry 102 or equivalent. 4 hours.
230. **Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Animal Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104; one course in chemistry. 3 hours.
300. **Special Problems.** Supervised research on any phase of dairy science, including bacteriology and microbiology, biochemistry, feeding and nutrition, genetics, and physiology. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval are required prior to advance enrollment and registration. 1 to 5 hours, or $\frac{1}{2}$ to 1 unit.
305. **Genetics and Animal Improvement.** Same as Animal Science 305. Principles of heredity and their application to the problems of animal improvement. Prerequisite: Dairy Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit).
308. **Physiology of Lactation.** The anatomy and endocrinology of mammary development; the environmental, endocrinological, and biochemical factors which affect the yield and composition of milk. Prerequisite: Chemistry 102 or 103, Zoology 104 or equivalent with consent of instructor. 4 hours or 1 unit.
316. **Population Genetics.** Same as Biology 316. Mathematical theory of the genetics of populations: estimation of gene frequency, Hardy-Weinberg principle, systems of mating, relationship between relatives, and forces that change gene frequency; applications to man, animals, and plants. Students desiring 4 hours or 1 unit credit do additional work in some area of population genetics. Prerequisite: Dairy Science 110, or Biology 210 and college algebra, or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.

- 320. Nutrition and Digestive Physiology of Ruminants.** Same as Animal Science 320. Physiology and microbiology of digestion in the ruminant, and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Dairy Science 221. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
- 330. Reproduction and Artificial Insemination of Farm Animals.** Same as Animal Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science 100 or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
- 334. Marketing of Dairy Products.** Same as Agricultural Economics 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, mark-up laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; and expanding markets for dairy products. Inspection trip; estimated cost, \$5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or 12 hours of dairy science or dairy technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 340. Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
- 350. World Animal Agriculture.** Same as Animal Science 350. Survey and interpretations of the role of animal agriculture in various cultures of the world and particular references to underdeveloped countries of the world; discussion of the importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 402. The Microbiology and Physiology of Ruminant Nutrition.** Physiological and microbiological aspects of ruminant digestion and their influence on the metabolism of the extraruminal tissues; interpretation of nutritive requirements in terms of rumen microbial activities; and evaluation of research techniques. Prerequisite: Biochemistry 350 or equivalent. $\frac{3}{4}$ unit.
- 410. Current Topics in Nutritional Research.** Same as Nutritional Sciences 410 and Food Science 410. Discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350 and an upper-division course in nutrition. $\frac{3}{4}$ unit.
- 411. Chemistry of Nutritional Processes.** Same as Nutritional Sciences 411 and Food Science 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350 and an upper-division course in nutrition. 1 unit.
- 412. Advanced Endocrinology.** Same as Animal Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312 or Zoology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated for credit not to exceed a total of 2 units.
- 416. Quantitative Genetics.** Same as Biology 416. The mathematical theory of the genetics of quantitative traits: properties of random-mating populations; estimation of repeatability, heritability, and genetic correlation; genetic results of selection; aids to selection; correlated response; and selection for more than one trait. Applications to animal and plants. Prerequisite: Dairy Science 316 and 340, or consent of instructor. 1 unit.
- 430. Physiology of Mammalian Germ Cells.** Literature and laboratory course covering the recent theories and developments on the formation, transportation, and livability of spermatozoa and ova within the body, and their metabolism and preservation in vitro. Prerequisite: Dairy Science 330, Animal Science 406, and Biochemistry 350, or consent of instructor. 1 unit.

440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Dairy Science 340 or equivalent. $\frac{3}{4}$ unit.
481. **Animal Biochemical Laboratory Techniques.** Same as Animal Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences; isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; and determination of metabolic pathways and processes. Prerequisite: Biochemistry 350 and 355; consent of instructor. 1 unit.
490. **Dairy Science Seminar.** Discussions of current research and literature. Registration for 0 or $\frac{1}{2}$ unit every semester is required for graduate students majoring in dairy science. 0 or $\frac{1}{2}$ unit.
493. **Special Problems.** Individual investigation in any phase of dairy science. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.

DANCE

Head of Department: Professor O. J. Kostock

Department Office: 4-305 Krannert Center for the Performing Arts, Urbana

101. **Beginning Modern Dance.** Introduction to basic dance technique and movement improvisation; the study of motion as an art, group relationships in improvisation, and discussion of choreographic ideas. For nondance majors. 1 hour. May be repeated for a maximum of 4 hours.
102. **Intermediate Modern Dance.** Intermediate dance technique and improvisation. For nondance majors. Prerequisite: Dance 101 or consent of instructor. 1 hour. May be repeated for a maximum of 4 hours.
150. **Orientation to Dance.** Orientation to the field of dance and its place in education; general dance history, history of modern dance movement, philosophy of dance, and discussion of theories and problems involved in dance education. Students in the teaching of dance curriculum are required to enroll in Secondary Education 101, dance section. 2 hours.
160. **Beginning Technique.** Beginning modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
162. **Improvisation, I.** Experience in selective and basic processes of movement involvement, both individual and group; attention to organic and economical use of movement, the dynamics and quality of which are necessary to the activity being performed. 1 hour.
163. **Improvisation, II.** Continuation of Dance 162, with emphasis on expanding bodily activity into various existing or created performing environments (composed of sound, lights, and costumes); attention to expanding audience-performer relationships, to audio-visual effects, and to collaborative work with musicians, designers, and technicians in these related areas. Prerequisite: Dance 162 or consent of instructor. 1 hour.
164. **Beginning Composition.** Theory and practice in principles of dance composition; emphasis on solo creative work using various approaches to composition. Prerequisite: Dance 163 or consent of instructor. 2 hours.
165. **Intermediate Technique.** Intermediate modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. Prerequisite:

- site: Dance 160 or consent of instructor. 2 or 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
166. **Beginning Ballet, I.** Prerequisite: Dance 160 or consent of instructor. 1 hour. May be repeated once for credit.
167. **Beginning Ballet, II.** Prerequisite: Dance 166 or consent of instructor. 1 hour. May be repeated once for credit.
168. **Music Theory and Practice for Dance, I.** Analysis and organization of movement and music in terms of its rhythmic components, time, and force. 2 hours.
169. **Music Theory and Practice for Dance, II.** Progressive continuation of Dance 168, with emphasis on music theory, rhythmic awareness, and interpretation of melodic material; theory and practice in accompanying dance classes; and familiarity with existing music for the dance. Prerequisite: Dance 168 or consent of instructor. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
243. **Creative Dance for Children.** Theory and method of teaching dance to children; supervised practical teaching experience with first-through eighth-grade children. Prerequisite: Dance 163 and 165, or consent of instructor. 3 hours.
244. **Teaching of Dance.** Theory and practice in methods of teaching dance at the high school level, including lesson planning and curriculum construction. Students in the teaching of dance curriculum are required to enroll in Secondary Education 241. Prerequisite: Dance 243 or consent of instructor. 3 hours.
245. **Dance in the Elementary School.** Theory and practice in methods of teaching dance in the elementary school; practical experience in observation and teaching within an elementary school system. Prerequisite: Dance 243. 2 hours.
260. **Advanced Technique, I.** Advanced modern dance technique. Prerequisite: Dance 165 or consent of instructor. 2 or 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
264. **Intermediate Composition.** Experience in choreographing a minimum of one solo and two group works utilizing various approaches to choreographic form. Prerequisite: Dance 164 or consent of instructor. 2 hours.
266. **Intermediate Ballet, I.** Prerequisite: Dance 166 or consent of instructor. 1 hour. May be repeated once for credit.
267. **Intermediate Ballet, II.** Prerequisite: Dance 266 or consent of instructor. 1 hour.
340. **History of Dance, I.** Survey of dance from its beginnings in primitive societies through the nineteenth century. Prerequisite: Consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
341. **History of Dance, II.** Survey of the development of dance in the twentieth century. Prerequisite: Dance 340; consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
345. **Dance Production Workshop.** Experience in choreography and production of group compositions with special emphasis on staging, lighting, and costuming. Prerequisite: Dance 264 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
346. **Theory and Philosophy of Dance.** Study of the relationship of aesthetic principles and dance theory to a philosophy of dance in education and of dance as a performing art. Prerequisite: Dance 340 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
350. **Dance Repertory Workshop.** Experience in learning, rehearsing, and perfecting concert dance pieces under the direction of experienced choreographers. Prerequisite: Enrollment in advanced technique course; consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated for a maximum of 12 hours or 2 units.
351. **Special Problems.** Special projects in research or creative investigation taught on an individual basis. Prerequisite: Junior standing; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated for a maximum of 8 hours or 2 units.
360. **Advanced Technique, II.** Advanced modern dance technique. Prerequisite: Dance 260 or consent of instructor. 2 or 3 hours or $\frac{1}{2}$ unit (summer session, 2 hours or $\frac{1}{4}$ unit). May be repeated for a maximum of 12 hours or 2 units.
365. **Advanced Composition.** Work in advanced composition for the experienced student choreographer, including performance of at least one work. Prerequisite: Dance 264 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

380. **Introduction to Dance Therapy.** Introduction to dance used as therapy: lecture-discussions emphasize theoretical basis of the therapeutic process, current research trends, and assessment of movement for diagnostic or remedial purposes; fieldwork assignments with TMH children provide observational experience of actual dance therapy sessions. Prerequisite: Psychology 338; consent of instructor. 3 hours or 1 unit.
381. **Techniques of Dance Therapy.** Examination of general remediation techniques used in dance therapy sessions; introduction to content and methods of dance therapy with specific disability groups, such as physically or mentally handicapped and emotionally disturbed; and fieldwork experience to supplement lectures. Prerequisite: Dance 380; consent of instructor. 3 hours or 1 unit.
400. **Problems in Dance Education.** Basic historical, philosophical, and scientific foundations and developments in dance education; teaching methods; development of compositional problems; creative methods of instruction; and organizational problems of dance groups and public dance performance. Prerequisite: Dance 243 or 244, or equivalent. 1 unit.
401. **Choreography.** Experience in choreographing a minimum of one solo and one group composition to be presented at the end of the semester. Prerequisite: Dance 345 or equivalent. Students may reregister for a maximum of 2 units with the permission of the head of the department. $\frac{1}{2}$ to 2 units.
490. **Dance Seminar.** Student presentation of thesis reports in dance; informal discussions, demonstrations, lectures, and critical analysis of current problems in dance by professional guests. 0 credit.
499. **Thesis Research.** Preparation of thesis in dance. $\frac{1}{2}$ to 2 units.

ECONOMICS

Chairman of Department: Professor P. T. Hartman

Department Office: 330 Commerce Building (West), Urbana

102. **Principles of Economics, I.** Introduction to monetary theory, national income theory, and growth theory; public policy in the areas of economic stability and growth; historical development of the American economy; and population problems. Prerequisite: One semester of college work. 3 hours.
103. **Principles of Economics, II.** Introduction to the theory of product prices; the theory of the firm under varying conditions of competition and monopoly; productive resource pricing; international economics; regional economics; and related public policy questions in these areas. Prerequisite: Economics 102. 3 hours.
108. **Elements of Economics.** A general survey of the operation of the economic system, with reference to the business firm; the determination of price and output; the level of national income and the general price level; the monetary and banking system; public finance; labor relations; and international trade. For noncommerce students only. Prerequisite: First-semester freshman in engineering; second-semester freshman in other colleges. Not open to students who have had Economics 102 and 103. 3 hours. One additional hour of credit is received if a student enrolls in Economics 109.
109. **Current Economic Problems.** An economic analysis of specific economic problems dealing with poverty, economic development, international economics, and other contemporary issues. Prerequisite: Concurrent registration in Economics 108. 1 hour.
171. **Introductory Economic Statistics.** An introduction to statistical methods as applied in economics and other social sciences; descriptive statistics, hypothesis testing, and estimation including contingency tables, linear statistical models, and classical time series. For noncommerce students only. Students may not receive credit for Economics 171 in

addition to Economics 172 and 173, Mathematics 161, or Psychology 135. Prerequisite: Concurrent registration in Mathematics 134. 3 hours.

172. **Economic Statistics, I.** An introduction to the modern theory and methodology of statistics in the areas of economics and business; choice of best alternatives under conditions of uncertainty; frequency distributions and probability, the payoff table, and expected values as decision criteria; the cost of uncertainty and of irrationality; the use of new information; marginal, joint, and conditional probabilities; and sample design and statistical inference. Prerequisite: Mathematics 134 or equivalent; credit or concurrent registration in Economics 102 or 108. 3 hours.
173. **Economic Statistics, II.** Continuation of Economics 172. Emphasis on methods of estimation of basic parameters in linear models; growth curves, simple and multiple regressions, and correlation; linear combinations of ratios and percentages; index numbers, their construction and use; hypothesis testing and linear functions; and contingency tables and variance analysis. Prerequisite: Economics 172 or equivalent. 3 hours.
195. **Freshman Honors Seminar.** A seminar on selected topics of current interest in economics. Open to freshman James Scholars only. 3 hours.
196. **Honors Seminar.** A seminar on selected topics of current interest in economics. Open to freshman and sophomore James Scholars only. Prerequisite: Economics 108. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
214. **Government Finance and Taxation.** A general survey of government finance at the federal, state, and local levels, including government expenditures, principles of taxation, intergovernmental fiscal relations, public borrowing, debt management, and fiscal policy for economic stabilization. Prerequisite: Economics 103 or 108. 3 hours.
236. **American Economic History.** Westward movement; growth of industry, agriculture, commerce, finance, transportation, trust movement, and labor since 1790. Prerequisite: Economics 103 or 108; junior standing. 3 hours.
238. **European Economic History.** Economic structure and development of Europe since 1000 with respect to agriculture, industry, trade, technology, finance, and government; emphasis on those forces which contribute to the economic development of Europe and on the spread of these forces throughout the world. Prerequisite: Economics 103 or 108. 3 hours.
240. **Labor Problems.** Survey of the nature and causes of the problems of the American wage earner; economic insecurity, wages, hours, substandard workers, and the efforts of wage earners and society to solve these problems through organization and legislation. Prerequisite: Economics 103 or 108. 3 hours.
245. **Women in the Labor Market.** Changing role of women in the labor market and the economy; supply and demand for women in the 1970s: nature, extent, and legal remedies for sex discrimination in employment; "earnings gaps" and variable employment costs, men versus women; new role of multi-earner families; and comparative use of women as a professional resource. Prerequisite: Economics 103 or 108. 3 hours.
255. **Comparative Economic Systems.** Analysis of the significant similarities and differences in the development, structure, and policies of capitalism, communism, and market socialism. Prerequisite: Economics 103 or 108. 3 hours.
272. **Introduction to Econometrics.** The use of models in the study of economic relations; single-equation least-squares; analysis of variance; and multiequation models. Prerequisite: Economics 173; Mathematics 134. 3 hours.
288. **Government Regulation of Economic Activity.** Analysis of the economic bases, policies, and consequences of government regulation of economic activity; study of economic patterns of regulation in selected areas. Prerequisite: Economics 103 or 108. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in economics; may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.

295. **Senior Research.** A research and readings course for students majoring in economics; may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
299. **Undergraduate Open Seminar, II.** An independent study course covering topics not treated by regular course offerings. Requests for activation of this course may be made by students or by faculty and should be directed to the head of the department. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. Prerequisite: Junior or senior standing; Economics 102, 103, or 108 recommended. 0 to 9 hours. May be repeated.
300. **Intermediate Microeconomic Theory.** Microeconomic analysis including value and distribution theory; analysis of the pricing of the factors of production integrated in a micro-general equilibrium context which builds towards explaining the resource allocation process. Students may not receive graduate credit for both Economics 300 and Business Administration 500. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit. Upon recommendation by his adviser and approval by the Department of Economics, a noneconomics major may receive up to $\frac{3}{4}$ unit. Graduate credit for both Economics 300 and 400 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
301. **Intermediate Macroeconomic Theory.** The modern theory of the determination of the level and rate of growth of income, employment, output, and the price level; discussion of alternate fiscal and monetary policies to facilitate full employment and economic growth. Students may not receive credit for both Economics 301 and Business Administration 501. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit. Upon recommendation by his adviser and approval by the Department of Economics, a noneconomics major may receive up to $\frac{3}{4}$ unit. Graduate credit for both Economics 301 and 401 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
302. **Economic Analysis.** An introduction to the theory of income and employment, price and allocation, and instability and growth. Prerequisite: Economics 108 or enrollment in National Science Foundation Summer Institute in Economics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Summer session only.
306. **History of Economic Thought.** The development of economics; the examination of contributions of individual writers and schools of thought as they influenced economic thought and national policy. Prerequisite: Economics 103 or 108; senior standing. 3 hours or $\frac{1}{2}$ unit.
312. **Economic Dynamics and Growth.** Analysis of the causes of economic instability; the requirements for economic growth in the national economy; and a consideration of public policy relating to instability and growth. Prerequisite: Economics 103 or 108; Economics 301. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **Economics of Consumption.** Same as Home Economics 313. Analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
315. **The Economics of Poverty and Income Maintenance.** Same as Labor and Industrial Relations 315. Analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **The Economics of Black America.** Examination of the effects of racial discrimination on the economic status of the black individual in America; concentration on the contemporary period; the economics of discrimination; the effect of public policies on black income, employment, and housing; and the economic development of the black community. Prerequisite: Economics 108 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

- 328. International Economics.** Introduction to the theory of international trade and finance with selected application to current problems of commercial policy, balance of payments adjustment, and the international monetary system. Prerequisite: Economics 102 and 103, or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 329. Contemporary Issues in the International Economy.** Analysis in depth of selected current issues and policy problems of the international economy, including (but not restricted to) the following: new approaches to the theory of international trade, reform of the international monetary system, role of the General Agreement on Tariffs and Trade and the United Nations Conference on Trade and Development in expanding trade between developed and undeveloped economies, problems of stabilizing international commodity markets, and balance of payments problems of the United States and other selected countries. Prerequisite: Economics 328 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 335. American Financial History.** American monetary history and the development of the present monetary system; the rise of commercial, investment, and central banking and of other financial institutions; and the financing of government, especially of major wars. Prerequisite: Finance 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 337. Economic History of American Agriculture.** Same as Agricultural Economics 337 and History 337. Development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college level course in basic economics or American history. Graduate students who take this course for 1 unit credit are required to do extra work; the student writes a scholarly paper on some approved topic in agricultural history. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 341. The Economics of Labor Markets.** Same as Labor and Industrial Relations 341. Study of the theory and empirical research in wage determination, wage structure, economic effects of unions, and macroeconomic labor market problems. Topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; and employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 343. Unions, Bargaining, and Public Policy.** Same as Labor and Industrial Relations 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States including theory of the labor movement; process of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; and problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 345. Economics of Manpower.** Same as Labor and Industrial Relations 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; and private industry and union manpower planning. Graduate credit is not given for both Economics 345 and 444. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 349. Senior Seminar in Labor Economics.** Preprofessional course intended to unify other courses in labor economics and closely related fields including studies of research techniques and sources; individual readings in current literature; preparation of research reports and papers; and consideration of professional employment opportunities and graduate study in labor economics and industrial relations. Prerequisite: Economics 240; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 350. The Developing Economies.** Analysis of the economic problems associated with newly developing nations; emphasis on their economic structures, their factor scarcities, and their programs for development. Not open for graduate credit for graduate candidates in economics. Graduate credit is not given for both Economics 350 and Economics 450 or 451. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ to 1 unit.

352. **Economic Development in Latin America.** Same as Agricultural Economics 352. Study of economic activity and the processes of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Economic Development in India and Southeast Asia.** Same as Agricultural Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Economic Development of Tropical Africa.** Same as Agricultural Economics 354. Types of African economies and growth of the exchange economy; development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental planning, and development projects; and demographic, land tenure, and institutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **The Soviet Economy.** Analytical survey of Soviet economic development; structure and performance of the economy; and problems of planning and control. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **The Economy of China.** Discussion of changes in the patterns of production, exchange, and distribution in Communist China, with emphasis on their relation to social transformation; survey of Chinese economic history over the past century, dealing with the institutional background to and the structure of economic activities in China. Prerequisite: Economics 103 and 108, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **The Israeli Economy.** An analysis of the economic structures, policies, and performance of modern Israel, emphasizing the pre-1948 Palestine economy; the development of the Histadrut, Kibbutz, and Moshav; the economic relations between Arab and Jewish populations; and the impact of post-1948 immigration on Israel's economic development. Prerequisite: Economics 108 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
360. **Regional Economic Development.** Survey of the theory and problems of regional economic development, including regional accounts, interregional income and trade theory, principles of the location of economic activity, theories of regional growth, and public policy for development of regions. Prerequisite: Economics 103 or 108. A student receiving credit for Economics 360 may not receive credit for Economics 460 or 461. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **The Urban Public Economy.** Same as Finance 367. Economic analysis of public policy with respect to urban problems; a full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; and the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land-use controls, pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or $\frac{1}{2}$ or 1 unit.
367. **Mathematical Economics, I.** Mathematical reformulation and interpretation of traditional economic theory. Prerequisite: Mathematics 141; Economics 300 and 301, or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
368. **Mathematical Economics, II.** Introduction to linear and nonlinear economic models; emphasis on the formulation and interpretation of modern economic theory and welfare economics. Prerequisite: Mathematics 124 or 315; Mathematics 141; Economics 300 or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
375. **National Income and Business Forecasting.** Same as Business Administration 375. The significance of national income and related economic accounts for analysis and forecasting of business conditions; the development of interrelations between data systems used by government agencies and business concerns in program planning and current decision making; and the introduction of models for solving problems in this area. Prerequisite: Economics 103 or 108; Economics 171. 3 hours, or $\frac{1}{2}$ or 1 unit.
384. **Economics of Transportation.** Economic aspects of the transportation industry with

special emphasis on problems of regulation and public policy. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.

386. **Current Transportation Problems.** Analytical and critical study of selected problems of current interest in transportation. Prerequisite: Economics 384 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Industrial Competition and Monopoly.** The organization and tactics of market control; the development of antitrust law and policy; public policy regarding competitive practices; special policies applying to natural resource industries; and regulated monopoly and government ownership as alternatives to the antitrust approach. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
400. **General Economic Theory.** Emphasis on microeconomic theory; principal topics include a review of value and distribution theory, the theory of choice by households and firms, general microeconomic theory, and theoretical developments of current interest; and attention given to empirical studies intended to affirm or disaffirm economic principles. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 400 and Business Administration 500. Prerequisite: Economics 103 or 108. 1 unit. Graduate credit for both Economics 300 and 400 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
401. **General Economic Theory.** Emphasis on macroeconomic theory and the relationship of economics to the other social sciences; principal topics include a review of Keynesian macroeconomic theory, formal growth theory, selected business cycle theory, the theory of socioeconomic change, and an outline of the differentiation and integration of economics and other social sciences. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 401 and Business Administration 501. Prerequisite: Economics 103 or 108. 1 unit. Graduate credit for both Economics 301 and 401 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
402. **Economic Theory.** Development of modern microeconomic theory: utility functions and demand; production functions and cost; linear programming; price and nonprice policy by the firm; market equilibria; income distribution; and general equilibrium including input-output analysis. Given in two sections: one offering a primarily mathematical presentation; the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics; for mathematical section, a knowledge of algebra and calculus. 1 unit.
403. **Economic Theory.** Development of modern macroeconomic theory; the Keynesian model of employment, interest, and money; its extension to international trade; fiscal policy and macroeconomic theory of distribution; the consumption function; and the theory of growth and cycles in terms of difference and differential equations. Given in two sections: one offering a primarily mathematical presentation; the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics; for mathematical section, a knowledge of algebra and calculus. 1 unit.
406. **History of Economic Thought.** Analysis of economic thought from the Physiocrats to the present; evaluation of the selected materials both as reflections of their times and as contributions to contemporary economic thought. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
408. **Philosophical Problems in Economics.** Study of philosophical problems in economics, with some emphasis on the methodology and epistemology of economic theory; use of the views of leading economists to show the development of broad philosophical problems of economic theory, the relation of theory and certain of its applied areas, and the relation of economics to other selected disciplines. These problems are treated in the light of modern scientific philosophy. Prerequisite: One unit either in economic theory or in the history of economic thought. 1 unit.

409. **Marxian Economics.** Analysis of Marx's economic theory and predictions; concentration on a critical evaluation of Marx's economic theory, a survey of contributions to the theory since Marx, and a Marxist evaluation of the neoclassical synthesis. Prerequisite: Economics 300 and 301, or consent of instructor. 1 unit.
410. **Advanced Topics in Economic Theory, I.** Study at an advanced level of one or more of the following possible topics: economics of externalities, advanced aggregate economic theory, theory of central planning, investment theory, consumer behavior theory, capital theory, welfare economics, inflation theory, income distribution theory, or other topics. Prerequisite: Economics 402 and 403, or consent of instructor. 1 unit. May be repeated for credit.
411. **Advanced Topics in Economic Theory, II.** Study at an advanced level of one or more of the following possible topics: economics of externalities, advanced aggregate economic theory, theory of central planning, investment theory, consumer behavior theory, capital theory, welfare economics, inflation theory, income distribution theory, or other topics. Prerequisite: Economics 402 and 403, or consent of instructor. 1 unit. May be repeated for credit.
414. **Public Finance.** Analysis of government expenditures and decision making; the budgetary process; fiscal policy; government borrowing and debt management; intergovernmental fiscal relations; pricing of government services; and public finance in developing economies. Prerequisite: Six hours of economics. 1 unit.
415. **Economics of Taxation.** Principles of taxation; incidence and distribution of tax burden; economic analysis of the major taxes: the personal and corporate income taxes, sales and excise taxes, property tax, and others; and taxation and economic development. Prerequisite: Six hours of economics. 1 unit.
420. **Monetary Theory.** Critical examination of monetary theories and their neoclassical antecedents; topics include the quantity theory, liquidity preference, the demand for money, velocity, theories of the level and term structure of interest rates, asset theory, and money in static and dynamic macro-general equilibrium models. Prerequisite: A course in income and employment theory or consent of instructor. 1 unit.
421. **The Theory of Monetary Policy.** Use of theories of central banking, debt management, financial intermediaries, and the monetary behavior of firms and households to explore current issues in the theory of monetary policy; current empirical research reviewed with emphasis on econometric studies of monetary behavior. Prerequisite: A course in money and banking, in macro-economic theory, calculus and statistics, or consent of instructor. 1 unit.
425. **Macroaccounting.** Same as Accountancy 455. Examination of the fundamental concepts underlying the attempts to measure the economic activities of macro-units; similarities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macroaccounting statements and analyses; and usefulness of macroaccounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macroeconomic theory or consent of instructor. 1 unit.
428. **International Trade Theory.** Development and use of the neoclassical theory of international trade for the analysis of tariffs, customs, unions, and the effects of trade on the distribution of income and welfare; analysis and use of the relations between the balance of payments and national income to study the role of income changes combined with price changes in the balance of payments adjustment process. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
429. **International Trade Policy.** Concepts of balance of payments equilibrium, the foreign exchange market and the theory of capital movements; current problems and policies related to balance of payments disequilibrium, trade policy, and the functioning of the international monetary system. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
436. **American Economic History.** Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organi-

zations, capital growth, money and banking, foreign and domestic commerce, and social progress. Material chiefly since 1790. Not open to students who have had Economics 236. 1 unit.

- 437. General Economic History.** Treatment of selected topics in the economic history of industrialized economies by applying economic theory and quantitative methods of analysis to historical problems; exploration of the implications for contemporary work in economics. Prerequisite: Graduate standing in economics or consent of the instructor. 1 unit.
- 438. Economic History of Europe.** Major lines of development since 1450; comparative study of forces and institutions inimical or favorable to growth; and selected readings on organization of economic activity, role of governments and the entrepreneur, commercial policy, monetary systems, land tenure, process of capital formation, industrialization, etc. Prerequisite: Consent of instructor. 1 unit.
- 440. Labor Economics.** Same as Labor and Industrial Relations 440. Survey of recent trends in the labor force, of real and money earnings, and of the distribution of national income used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.
- 441. Labor Economics.** Same as Labor and Industrial Relations 441. Economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free enterprise economy); emphasis in all cases on the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
- 442. Collective Bargaining.** Same as Labor and Industrial Relations 442. Development of a theory of the continuing interactions between unions and management which define and modify the role of each and the terms of employment; use of appropriate social science concepts; and emphasis on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority, and on the interactions between the parties and governmental process. Graduate credit is not given for both Economics 343 and Economics 442 or Labor and Industrial Relations 442. Prerequisite: Consent of instructor. 1 unit.
- 443. Problems and Practices of Labor Dispute Settlement.** Same as Labor and Industrial Relations 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling; analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit.
- 444. Economics of Manpower Resources.** Same as Labor and Industrial Relations 444. Emergence of the manpower resource issue; population as a resource base; the labor force: measurement and characteristics, behavior under changing income, employment, and technology; women as the dynamic factor in labor force growth; problems of utilization of labor force components: intellectual resources, older workers, and manual, white collar, Negro, and marginal forces; and issues of national manpower policy. Graduate credit is not given for both Economics 345 and 444. Prerequisite: Consent of instructor. 1 unit.
- 447. Labor Union Organization and Administration.** Same as Labor and Industrial Relations 447. Analysis of the structure, functions, and government of the modern American trade union movement; survey of the environmental factors, objectives, and action programs with considerable emphasis on economic and internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit.
- 450. The Economics of Development and Growth.** Review and analysis of the theories and patterns of growth in developed and underdeveloped economies; consideration of the problems and methods of measuring growth; critical examination of the variables thought to be strategic in the growth process; and exploration of the policy implications of different theories. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.

451. **The Developing Economies.** Analysis of the newly developing economies, with emphasis on institutional factors affecting development and economic policy relating to development. Prerequisite: Economics 450. 1 unit.
455. **Comparative Economic Systems.** Comparative analysis of the structures and policies of market-directed and planned economies. Prerequisite: Economics 103 or 108, or equivalent. 1 unit.
457. **Economic Planning in the Soviet Union and Eastern Europe.** Intensive examination of the structure and performance of the Soviet and the East European economies, emphasizing analysis of the main theoretic and operational dimensions of economic planning; evaluation of choice, design, and efficacy of central planning instruments from both theoretical and historical perspectives. Prerequisite: Economics 300 and 301, or 357, or consent of instructor. 1 unit.
460. **Location Theory.** Theory of location of economic activity in modern economic analysis; synthesis and application of production and location theories to regional structure and interregional and international trade and development. Credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
461. **Urban and Regional Economic Development.** Measurement and analysis of interregional differences in economic growth. Credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301. 1 unit.
467. **Mathematical Economics, I: Statics.** Study of quantitative techniques useful in economic analysis and decision making; mathematical programming; input-output analysis; point-set theory and game theory; existence, optimality, and stability conditions for static general equilibrium; and activity analysis, including welfare economics. Prerequisite: Mathematics 315; Economics 402 and 403, or equivalent. 1 unit.
468. **Mathematical Economics, II: Dynamics.** Study of quantitative techniques useful in economic analysis and decision making; single and systems of difference and differential equations; dynamic programming; Pontryagin maximum principle; interaction of multiplier and accelerator; von Neumann model; Turnpike theorem; growth models; and control systems. Prerequisite: Mathematics 315; Economics 402 and 403, or equivalent. 1 unit.
470. **Economic Statistics.** Classical statistics and regression analysis; descriptive statistics, probability and point and interval estimation; decision theory; variance analysis; and linear regression and least-squares estimates. Prerequisite: Consent of instructor. 1 unit.
471. **Economic Statistics.** Part 1: the construction of econometric models; characteristics of models and choice of estimating methods; and estimates of parameters by various methods. Part 2: Bayesian statistics and decision theory. Prerequisite: Economics 470 or equivalent. 1 unit.
476. **Econometrics, I.** Estimation of parameters for single-equation models; tests of hypotheses and confidence regions for regression models; large-sample theory in single-equation models; and Bayesian statistics in regression models. Prerequisite: Mathematics 315 and 363. 1 unit.
477. **Econometrics, II.** Consideration of the specification of models with systems of simultaneous equations; identification problem, distributed lag models, K-class estimators, maximum likelihood estimators, three-stage least-squares, and effects of specification errors. Prerequisite: Economics 476. 1 unit.
479. **Research Seminar in Quantitative Economics.** Significant work in the area of quantitative economics is reported and explored by members of the instructional staff, by guest speakers from academic, governmental, and industrial centers, and by graduate students in the second year of their work who are assigned projects. Prerequisite: The equivalent of one year of graduate statistics (theoretical or applied), calculus, and the equivalent of one year of mathematical economics. 1 unit. (Credit for second-year students only.)
480. **Industrial Organization.** Theory of the organization of markets and firms, behavior of firms, functioning of competitive systems, and performance of markets. 1 unit.

- 481. Industrial Organization and Public Policy.** Economic aspects of public policy relating to the maintenance of competition, public utility regulation, and natural resource regulation; survey of other forms of regulation and market organization in other countries. Prerequisite: Economics 480. 1 unit.
- 484. Economics of Transportation, I.** Study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. 1 unit.
- 485. Economics of Transportation, II.** Study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. 1 unit.
- 490. Individual Study and Research.** Directed reading and research. $\frac{1}{2}$ to 1 unit.
- 499. Thesis Research.** Preparation of thesis required of all students writing masteral or doctoral theses in economics. 0 to 4 units (summer session, 0 to 2 units).

EDUCATION

Dean of College: Dean J. M. Atkin

College Office: 110 Education Building, Urbana

- 100. Education Practicum.** A laboratory course involving work in school and research projects of the instructor's choosing. For those who choose this option, it is taken in conjunction with Rhetoric 101 and 102, or Speech Communication 111 and 112 and History and Philosophy of Education 201. 4 hours.
- 101. Education Practicum.** Continuation of Education 100. Prerequisite: Education 100 or consent of instructor. 4 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

Acting Chairman of Department: Professor F. D. Carver

Department Office: 320 Education Building, Urbana

A proposal is currently under consideration to change the name of this department to Administration, Higher, and Continuing Education.

- 430. Elementary School Organization and Administration.** Principal focus given to conceptual analyses of administrative and supervisory functions of the elementary school; examination of administrative roles in the design, implementation, and improvement of the total educational program; and intensive use of research skills and strategies in the investigation of problems of instruction. In summer sessions this course is restricted to those without experience in administration and must be taken with Educational Administration and Supervision 464. Intended primarily for candidates for the master's degree. Prerequisite: Consent of instructor. 1 unit.
- 438. Instructional Supervision.** Methods, theories, and research applying to supervision at all levels of public education; analyses made concerning the work of curriculum directors, general supervisors, special supervisors, supervising principals, and department heads; study of supervisory methods, current plans for staff utilization, and use of instructional materials; and stress on evaluation of educational programs and of the effects of supervision. Prerequisite: Elementary Education 439 or Secondary Education 439; Educational Administration and Supervision 450. 1 unit.

440. **Administration and Supervision of Junior and Senior High Schools.** Principal focus given to conceptual analyses of administrative and supervisory functions of the secondary schools; problems then projected through case studies and situational descriptions as a means of examining tasks and processes in such areas as curriculum and instruction, pupil and staff personnel, student activities, school organization, and management and school-community relationships. In summer sessions this course is usually taken with Educational Administration and Supervision 464. Intended primarily for candidates for the master's degree. Prerequisite: Educational Administration and Supervision 450 or consent of instructor. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student, and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
450. **Public Control and Administration of Education.** Basic understanding of theory and practice in operation and control of schools useful to teachers and other citizens; introductory course for prospective administrative officers and supervisors. Not open to experienced administrators nor to students who have taken any of the following (or equivalents): Educational Administration 430, 440, 461, 462, 463, 465, or 466. 1 unit.
451. **Administration of Educational Program.** Overview of the theory underlying the development and administration of educational programs; study of various program models and the relationships among elements of curriculum; and primary emphasis to the diverse considerations which influence program administration in schools serving today's complex society. Prerequisite: Educational Administration 450 or consent of instructor. 1 unit.
453. **Conceptual Approaches to Educational Administration.** Focus on the human and organizational dimensions of administration internal to the school system; foundation of selected social science concepts and theories for analyzing and understanding educational administration. Prerequisite: Educational Administration 450 and 451, or consent of instructor. 1 unit.
461. **Administration of Educational Programs and Personnel.** Study of principles and criteria for analysis of programs at various levels of operation, such as instructional departments and pupil personnel service units, individual schools, local school systems, intermediate units, state education departments, and the federal government. Educational Administration and Supervision 461, 462, and 463 constitute the required core program for all students specializing in educational administration who are candidates for a degree beyond the master's. Prerequisite: Educational Administration and Supervision 450, and 430 or 440. 1 unit.
462. **Organization and Business Administration of Public Education.** Organization and operation of public school government; functions and processes of school business administration, including internal organization of the division of business services; and scope and role of the business manager, budgetary process, accounting and financial reporting, contracts, liability, insurance, purchasing, auxiliary services, salary policies, and methods of survey, evaluation, and planning. Prerequisite: Educational Administration and Supervision 450, 430 or 440, and 461. 1 unit.
463. **The Role of Administrative Leadership.** Study of principles underlying administrative leadership drawn from such disciplines as philosophy, psychology, sociology, and public administration; application of these principles in the analysis and formulation of general procedures by which the process of administration may be carried on most effectively to develop and operate efficient educational programs. Prerequisite: Educational Administration and Supervision 461; Educational Psychology 413 or Educational Administration and Supervision 467. 1 unit.

464. **Directed Field Experience in Administration.** Direct experience in the study of educational problems of concern to administrators; features an action component whereby the student is provided with opportunities for assuming responsibility for decision making in a live or simulated setting; each student works under the supervision of a professor, and where possible and appropriate, a practicing administrator. 1 to 3 units. No more than 1 unit earned at the master's level.
465. **Personnel Administration.** Principles, problems, and trends in the administration of professional public school personnel; organization of personnel; assessment and definition of personnel needs; recruitment, selection, and induction; evaluation; personnel development programs; and teacher organizations. Prerequisite: Educational Administration and Supervision 430, 440, and 450. 1 unit.
466. **Public School Finance.** Advanced graduate study of the theory and technology of public school finance; attention centered on analysis of principles and theory underlying fiscal practice in various states; technical knowledge of designing controls, organization, and fiscal systems in harmony with expressed theory; and the application of research to the analysis of problems related to the improvement of financing public schools. Prerequisite: Admission to advanced graduate program in educational administration and supervision or consent of instructor. 1 unit.
467. **Foundations for Group Processes for Administrators.** Laboratory course in which members study group process through involvement in the class as a group; a text, related readings and relevant reports are used to guide critical study of the ethical, sociopsychological, and methodological ideas and problems underlying management and the improvement of groups; special attention is given to the function of group leadership in educational settings. Prerequisite: Educational Administration and Supervision 450; Educational Psychology 311; Educational Psychology 312. 1 unit.
468. **School-Community Relations.** Study of the relationship of the American school to the community; analysis of the power structure, social agencies, school liaison groups, and economic character of the community as they affect and are affected by the school; and evaluation of the various media of communication between the school and the larger community, and the development of criteria for an effective program of school-community relations. 1 unit.
469. **Legal Basis of School Administration.** Legal rights, privileges, responsibilities, immunities, and authority of pupils, parents, teachers, administrators, and school board members in relation to the school. 1 unit.
470. **Educational Facilities Planning.** Study of concepts and techniques for determining physical needs within the larger environmental context and for translating educational requirements into design criteria; emphasis on the planning process in relation to (1) community and social considerations, (2) pupil population forecasting, (3) program analysis and performance specification development, and (4) the creation of environments conducive to learning. Prerequisite: Educational Administration and Supervision 450. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in educational administration and supervision open only to persons who have been admitted for doctoral study in educational administration and supervision. 1 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations 497, Social Work 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.

499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units (summer session, 2 ½ units).

EDUCATIONAL PRACTICE

Offices for Student Teaching: Secondary Education, 236 Education Building; Elementary Education, 304 Education Building; Special Education, 1005 West Nevada Street, Urbana; and Vocational and Technical Education, 236 Education Building.

Students entering teacher education curricula with sixty or more semester hours should apply for student teaching assignments during the first semester in the curriculum. However, such students must complete at least a semester before they may be admitted to educational practice.

199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **Educational Practice in the Education of Exceptional Children.** A course in practice teaching providing teaching experience with exceptional children. Prerequisite: Senior standing; consent of department; sufficient hours of background courses. 2 to 5 hours.
232. **Educational Practice in Elementary Education.** A course in practice teaching to meet certification requirements for teaching in the elementary school. Prerequisite: Elementary Education 233 or 237 as required by the student's curriculum; senior standing. 2 to 5 hours.
238. **Educational Practice for Special Fields in Elementary Schools.** A course in student teaching to meet requirements for certification in special fields at the elementary school level. Prerequisite: For students in the early childhood education curriculum, Elementary Education 334 required; consent of instructor. 3 or 4 hours.
239. **Microteaching: Practice in Teaching Techniques.** Instruction and practice in basic teaching techniques; consideration of both teacher-centered and learner-centered techniques; systematic examination of each technique in terms of basic descriptive and evaluative procedures; and application of techniques to specific instructional situations. Prerequisite: Junior standing. 2 hours.
242. **Educational Practice in Secondary Education.** A course in practice teaching to meet certification requirements for teaching in the secondary school. Prerequisite: Secondary Education 240; senior standing. 2 to 5 hours.
250. **School and Community Experiences.** Observation and laboratory experience in the public schools to prepare students for student teaching. 2 hours.

EDUCATIONAL PSYCHOLOGY

Acting Chairman of Department: Professor T. J. Long
Department Office: 210 Education Building, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
211. **Educational Psychology.** Basic undergraduate course in psychology of education for prospective teachers; materials and principles from the various areas of psychology (mental hygiene, psychology of learning, etc.) applied to the practical problems of teaching. Prerequisite: Psychology 100. 3 hours.
236. **Child Development for Elementary Teachers.** Study of child growth and development designed particularly for those preparing to teach in the elementary school; special em-

phasis on the significance of the developmental process for educational programs and procedures; and systematic experience in studying and evaluating children's behavior and in handling children. Prerequisite: Psychology 100. 3 hours.

249. **Independent Study.** Study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructor; consent of adviser and staff member who supervises the work. 1 to 4 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
311. **Psychology of Learning for Teachers.** Consideration of learning situations in the light of psychological findings and concepts; development of a theory of learning and its application to the teaching of attitudes, skills, and understandings. Prerequisite: Educational Psychology 211; practice teaching or teaching experience. 2 hours or ½ unit.
312. **Mental Hygiene and the School.** Examination of social and emotional adjustment; study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, and behavior disorders in children; and introduction to methods of child study and provision for emotionally disturbed children. Prerequisite: Educational Psychology 211; practice teaching or teaching experience. 2 hours or ½ unit.
313. **Programmed Instruction.** Design, production, and evaluation of self-instructional materials, including delineation of objectives, task analysis, frame writing, frame editing, pilot testing and revision, and field testing; survey of current research and orientations toward programmed instruction; and consideration of the mechanized and text forms for presenting programs. Each student prepares a self-instructional program. Prerequisite: Educational Psychology 311. 4 hours or 1 unit.
326. **Introduction to Vocational Rehabilitation Counseling.** Survey of the history and development of vocational rehabilitation programs; contributions of related disciplines and their integration; and basic procedures and problems of vocational rehabilitation counseling. Prerequisite: Consent of instructor. 2 hours or ½ unit.
339. **Corrective Reading.** Same as Elementary Education 339. Practice in administering and interpreting group diagnostic reading tests; presentation of instructional techniques appropriate for less severe reading disabilities. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.
343. **Individual Intelligence Testing.** Fundamental concepts relevant to the general problem of the individual testing of learning aptitude; acquisition of psychometric competence in the use of the 1960 Binet and the Wechsler tests; and acquaintance and limited practice in the administration, scoring, and interpretation of results obtained by performance scales and other devices appropriate for use with individuals having sensory, associative, and/or motor impairments. Prerequisite: Consent of instructor and 6 hours of psychology and Special Education 324, or Educational Psychology 392 or Psychology 390. 3 hours or 1 unit.
360. **Educational Uses of Television and Radio.** Same as Radio and Television 360. Study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; and experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.
385. **Anthropology of Education.** Same as Anthropology 385 and History and Philosophy of Education 385. Introduction to the contribution of anthropology to the cross-cultural study of education; discussion of material from representative cultures ranging from primitive social groups to present-day national states; special attention to education of minority ethnic and subordinate cultures; and emphasis placed on both informal and formal education as cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: One course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or ½ or 1 unit.

387. **Computer Use in Education.** Overview of the nature and development of automation in education; use of electronic data processing systems for administrative purposes, for instruction, and for research; discussion of problems of computer management, natural language analysis, and simulation CAI applications; and laboratory experience with on-line terminals, remote entry devices, and peripheral equipment. Prerequisite: Educational Psychology 390 or equivalent, or consent of instructor. 3 hours or 1 unit.
390. **Elements of Educational Statistics.** Designed for terminal value for professional training of students not intending to pursue advanced graduate work, and for introductory value for students continuing graduate study in education; descriptive statistics, introduction to correlation and regression, the normal curve, statistical inference, and the presentation and interpretation of statistical data in educational literature. 3 hours or 1 unit.
391. **Construction and Use of Tests in Teaching.** The relationship of classroom testing to educational objectives and the curriculum; the construction, administration, and scoring of the various types of essay and short-answer tests; and other means of measuring the attainment of objectives and marking procedure. Designed primarily for classroom teachers. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.
392. **Introduction to the Principles of Measurement.** Study of the selection, preparation, administration, and interpretation of psychological and educational tests and diagnostic devices; emphasis on theory at a beginning level, with application to hypothetical school situations as a teaching device; and consideration of the sources of standard tests, criteria for their evaluation, methods of scoring, interpretation, and general and special areas. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.
399. **Issues and Developments in Educational Psychology.** Experimentation or seminar on topics not treated by regularly scheduled courses. Requests for initiation of the course may be made by students or by faculty members. 2 or 4 hours, or ½ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
411. **Psychology of Adolescence for Teachers.** Psychological significance of adolescence, its biological and social foundations, and its implications for education. Prerequisite: Educational Psychology 311 and 312. 1 unit.
412. **Advanced Child Development for Students of Education.** Consideration of the nature of the child and his development during the preschool and elementary school years; emphasis on development as a process of social learning; interpretation of the scientific literature as it concerns the educative process; and discussion of methods of studying and evaluating the behavior of the child as an individual and in group situations. Prerequisite: Educational Psychology 311 and 312. 1 unit.
413. **Social Psychology and the Problems of Education.** Consideration of the concepts and methods of social psychology as applied to the professional functions of teachers, administrators, and other persons engaged in education; opportunity to work upon field problems. Prerequisite: Educational Psychology 311, 312, and 390. 1 unit.
414. **The Psychology of College Teaching.** Designed particularly for graduate students minoring in education or preparing for college teaching. Psychoeducational problems in undergraduate and graduate teaching; special emphasis upon individual differences, remedial procedures, principles of learning, the technology of teaching and learning, adjustment problems of college students, counseling and advisory services, test construction, and analysis and use of test results and resource materials. Prerequisite: A course in psychology; consent of instructor. 1 unit.
415. **Psychological Theories Applied to Education.** An advanced course in human behavior required of all candidates for the degree of Doctor of Education; special attention given to contemporary systems of psychology and their relationship to educational practice. Prerequisite: Educational Psychology 311 and 312; Educational Psychology 411 or 412; candidacy for Ed.D. or Ph.D. in Education. 1 unit.
422. **Basic Principles of Counseling.** Study of counseling processes that are especially applicable to the problems of normal individuals; study of the theories of education and personality which underlie counseling procedures for the purpose of developing the stu-

dent's ability to evaluate these procedures. Prerequisite: Educational Psychology 311 and 312. 1 unit.

423. **The Use of Tests in Guidance.** Practice in interpreting test results in case studies; study of the implications on test choices and usage of the philosophic orientation of the counselor, the type of case, the case setting, and the case information available; and discussion of the advantages and disadvantages of particular tests for given types of cases. Prerequisite: Educational Psychology 392 and 422, or equivalent. 1 unit.
424. **Supervised Practice in Educational Psychology.** Intensive supervised experiences in applied educational psychology; use of a wide variety of diagnostic and observational techniques and treatment. Students may take more than one section. Prerequisite (dependent upon section): Master's degree in educational psychology or equivalent; consent of instructor. 1 to 2 units.
425. **Principles and Practices of Student Personnel Services.** For teachers, administrators, student advisers, and others who are interested in basic guidance principles and in guidance methods useful to schools and to agencies dealing with out-of-school youth and adults; consideration of the role of guidance specialists and the guidance functions of community agencies. 1 unit.
427. **Principles and Techniques of Group Guidance.** Study of the principles of group guidance and their application; review of the historical development of group guidance and the study of pertinent research. Discussion and role playing have an important part in the work of the course, and case materials are utilized. Prerequisite: Educational Psychology 311, 312, 422, and 423, and either 325 or 425; or consent of instructor. 1 unit.
428. **Theories of Career Development and the Use of Occupational Information.** Results of recent occupational research and use of these results by teachers and counselors; attention given to research techniques suitable for use in local occupational studies. Prerequisite: Educational Psychology 425 or an introductory course in counseling. 1 unit.
429. **Field Instruction in Counseling.** Individual instruction designed to help the advanced student apply the basic principles of counseling. Each student is assigned to a counseling agency. Prerequisite: Educational Psychology 422 and 424 (with consent of instructor, registration in Educational Psychology 424 may be concurrent). 1 or 2 units.
444. **Sociocultural Influences on Learning and Development.** Research and theory relating to the origin and development of achievement-related attitudes, motives, norms, and expectations; issues and problems associated with teaching children of diverse backgrounds. Prerequisite: Educational Psychology 311, 312, and 390, or consent of instructor. 1 unit.
446. **Research Methods in Human Development.** Introduction to methods and the design of research appropriate to the study of child and adult development; consideration of cross-disciplinary approaches, observational and experimental methods, methods for the assessment of social change, and the study of intergenerational differences in behavior. Prerequisite: Educational Psychology 496 or equivalent; 4 units of graduate work in education or the social or behavioral sciences. 1 unit.
447. **Seminar in Rehabilitation Counseling.** Problems of rehabilitation, including problems associated with specific physical and mental disabilities; critical examination of literature pertaining to rehabilitation, with emphasis on recent publications. Prerequisite: Educational Psychology 326 and 422. ½ unit. May be repeated for a maximum of 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study; develops the individual's ability as an independent student; and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. ½ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
485. **Multivariate Correlational Techniques in Educational Research.** Emphasis on educational research applications of correlational techniques; special attention to issues in

principles of research design underlying appropriate uses of such techniques as multiple, partial, and part (semipartial) correlation and factor analysis; and illustration of techniques by examples drawn from published studies and projects conducted on this campus. Emphasis will be placed on application and interpretation of techniques rather than on theoretical rationales. Prerequisite: Educational Psychology 496 or equivalent; consent of instructor. 1 unit.

487. **Classroom Transactions and Student Outcomes.** An advanced course in the investigations of relationships between classroom transactions and student outcomes; major topics include the methodology of observing and measuring classroom events, review of correlational and experimental research in classroom settings, and the design of future research in this area. Prerequisite: Educational Psychology 496 or consent of instructor; background work in educational theory assumed. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in educational psychology open only to persons who have been admitted for doctoral study in educational psychology. 0 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
492. **Psychology of Learning and Instruction.** Same as Psychology 492. An advanced course in the nature and conditions of long-term cognitive learning and retention in classroom and similar situations; intended for doctoral students with a special interest in research leading to the improvement of classroom teaching and learning, in psychological aspects of curriculum research, and in the cognitive aspects of military and industrial training. Prerequisite: Consent of instructor. 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Psychology 494 and Sociology 494. Principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
495. **Theory of Measurement.** Same as Psychology 495. Logical and mathematical principles underlying test design, construction, and validation, with particular emphasis on evaluating reliability of measurement, utility resulting from test-based decisions, and validity of descriptions of individuals. Prerequisite: Educational Psychology 496 or Psychology 307, or equivalent; Educational Psychology 390 or 392, or equivalent. 1 unit.
496. **Statistical Methods in Education.** First graduate course in statistical methods in education; introduction to the logic of scientific method in education; probability and sampling in education and correlation methods in educational measurements and research; partial and multiple correlation and the testing of statistical hypotheses; and other applications of statistics to educational research. Prerequisite: Educational Psychology 390, 1 unit.
497. **Advanced Statistical Methods in Education.** An advanced course in statistical methods applied to educational research; analysis of variance and covariance, experimental design, and introduction to multivariate statistical techniques including discriminant analysis. Prerequisite: Educational Psychology 496. 1 unit.
498. **Theory of Educational Evaluation.** Study of relationship between educational purposes, curriculum, and evaluation through emphasis on principles of evaluation dealing with classifications of behavior; detailed study of the concept of test validity, of its determination, and of its relation to test design, with emphasis on the evaluation of outcomes involving the higher mental processes; and guided practice in solving complex

problems of evaluating behaviors, some in subject matter areas but primarily those cutting across subject matter lines. Prerequisite: Educational Psychology 496. 1 unit.

499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

ELECTRICAL ENGINEERING

Head of Department: Professor E. C. Jordan

Department Office: 155 Electrical Engineering Building, Urbana

114. **Wiring and Illumination.** Fundamentals of commercial and industrial illumination and wiring practice. Prerequisite: Sophomore standing or consent of instructor. 3 hours. Engineering students receive no credit.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Seminar.** Discussions of educational programs, career opportunities, and other topics in electrical engineering. For electrical engineering students. 0 hours.
220. **Basic Electrical Engineering.** Fundamentals of electric and magnetic circuits and characteristics of electron tubes and circuits. Credit is not given for both Electrical Engineering 220 and 260. Prerequisite: Physics 106 and 107; Mathematics 140, 141, or 145. 3 hours. Electrical engineering students receive no credit.
229. **Introduction to Electromagnetic Fields.** Static electric and magnetic fields; elementary electromagnetic field theory as summarized in Maxwell's equations in integral and differential form. Prerequisite: Physics 107; Mathematics 345. 3 hours.
230. **Application and Control of Motors and Equipment.** Plant electrical systems; electric codes; motor types and applications; and power control devices and control systems. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
231. **Power Equipment Laboratory.** To accompany Electrical Engineering 230. Prerequisite: Credit or concurrent registration in Electrical Engineering 230. 1 hour. Electrical engineering students receive no credit.
232. **Electronics and Electronics Applications.** Theory and application of electronic circuits and equipment. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
233. **Electronics Laboratory.** To accompany Electrical Engineering 232. Prerequisite: Credit or concurrent registration in Electrical Engineering 232. 1 hour. Electrical engineering students receive no credit.
234. **Electrical Instruments and Measurements.** Theory and use of electrical instruments with special attention to their use in measuring nonelectrical quantities. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.
235. **Electrical Measurement Laboratory.** To accompany Electrical Engineering 234. Prerequisite: Credit or concurrent registration in Electrical Engineering 234. 1 hour. Electrical engineering students receive no credit.
244. **Electrical Engineering Laboratory, I.** Introduction to electronic instruments, basic measurement techniques, and basic electronic components; preparation for experimental projects. Prerequisite: Credit or concurrent registration in Electrical Engineering 260. 2 hours.
245. **Electrical Engineering Laboratory, II.** Laboratory projects in various areas of electrical engineering. Prerequisite: Electrical Engineering 244 and 340. 2 hours.
246. **Project Laboratory.** Planning, designing, executing, and evaluating various experimental projects by the student along with discussion of the actual examples of experimental design, error control, and data processing. Prerequisite: Senior standing in electrical engineering; consent of instructor. 2 to 4 hours.
249. **Digital Systems Laboratory.** Introduction to the experimental analysis and synthesis of digital networks. Prerequisite: Electrical Engineering 244, 290, or 294; credit or concurrent registration in Electrical Engineering 340; or consent of instructor. 2 hours.

260. **Networks, I.** Elementary signals; basic principles of network analysis; and sinusoidal steady-state analysis. Credit is not given for both Electrical Engineering 260 and 220. Prerequisite: Physics 107; credit or concurrent registration in Computer Science 101; Mathematics 345. 3 hours.
262. **Networks, II.** Laplace transforms; role of exponential and sinusoidal signals in system analysis for arbitrary wave forms; and two-ports and filters as signal processors. Prerequisite: Electrical Engineering 260; Mathematics 345; Computer Science 101. 3 hours.
266. **Probabilistic Methods in Electrical Engineering.** Applications of probabilistic concepts in electrical engineering problems; models of random phenomena in devices and systems; and elementary analysis and design problems involving statistical models in electrical engineering. Prerequisite: Electrical Engineering 260 or junior standing in electrical engineering. 3 hours.
271. **Electrical Engineering Special Topics.** Prerequisite: Approved written application to department as specified by department or instructor. 0 to 4 hours.
272. **Electrical Engineering Problems.** Prerequisite: Approved written application to department as specified by department or instructor. 0 to 4 hours.
288. **Economic Aspects of Engineering.** Fundamental principles of engineering economy. Prerequisite: Junior standing in engineering; consent of instructor. 3 hours.
290. **Introduction to Information Processing.** Engineering perspective to information processing from a computational standpoint; comparison and contrast of analog and digital systems to provide an appreciation of their respective characteristics and capabilities. Prerequisite: Computer Science 101; credit or concurrent registration in Mathematics 345. 3 hours.
296. **Honors Project.** Same as Aeronautical and Astronautical Engineering, Industrial Engineering, and Mechanical Engineering 296. A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Same as Aeronautical and Astronautical Engineering, Industrial Engineering, and Mechanical Engineering 297. Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Preliminary reading and investigation. 0 to 3 hours.
302. **Electronics and Acoustics of Music, I.** History of music, science and technology; spectra of basic sound signals and concept of voltage control; electronic circuits for sound synthesis; sound pressure measurement; sound perception; basics of acoustic wave propagation; and acoustics of string, wind, and percussion instruments. Credit is not given for both Music 302 and Electrical Engineering 302. Prerequisite: Electrical Engineering 342; Electrical Engineering 350 or 373. 3 hours or $\frac{3}{4}$ unit.
303. **Electronics and Acoustics of Music, II.** Acoustics of the voice; intervals, scales, tuning, and temperament; auditorium and room acoustics; artificial reverberation; microphones and loudspeakers; sound reinforcement; feedback problems; recording and reproduction of sound; and digital computer sound-processing techniques. Credit is not given for both Music 303 and Electrical Engineering 303. Prerequisite: Electrical Engineering 302. 3 hours or $\frac{3}{4}$ unit.
310. **Systems, I.** Fourier transform; matrix algebra; formulation of the normal-form equation in terms of the state variables; solution of the normal-form equation; convolution; and stability of systems. Prerequisite: Electrical Engineering 260. 3 hours, or 0 to $\frac{3}{4}$ unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Same as Nuclear Engineering 321. Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems; energy balance; plasma confinement and stability; and recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.

324. **Active and Passive Filter Design.** Properties of passive network functions; synthesis of RC and LC passive network functions; operational amplifier; RC active circuit synthesis; sensitivity of networks; approximation theory; and practical filter design. Prerequisite: Electrical Engineering 262 or 310. 3 hours, or $\frac{3}{4}$ or 1 unit.
330. **Electromechanics.** Quasi-static electromagnetic fields; lumped-parameter electromechanics; rotating machines; dynamics of electromechanical systems; and fields and moving media. Prerequisite: Electrical Engineering 229 and 260. 3 hours, or 0 to 1 unit.
332. **Electrical Machinery.** Induction machines; single-phase motors; direct-current machines; and applications. Prerequisite: Senior standing. 3 hours, or 0 to $\frac{3}{4}$ unit.
336. **Advanced Analysis of Electric Power Equipment.** Transformers; synchronous and induction machines; power machines in systems; single-phase motors; and extension of the two-reaction analysis to the general machine. Prerequisite: Senior standing. 4 hours, or 0 to 1 unit.
340. **Electronics, I.** Semiconductor materials and their electronic properties and applications to electronic devices; p-n junctions, transistors, and other diode and triode devices; and low-frequency applications of diodes. Prerequisite: Physics 108; Mathematics 345. 3 hours, or 0 to $\frac{3}{4}$ unit.
342. **Advanced Electronics.** Linear and nonlinear amplification; modulation and demodulation concepts; and introduction to feedback amplifiers and oscillators. Prerequisite: Electrical Engineering 244, 260, and 340. 3 hours, or 0 or $\frac{3}{4}$ unit.
344. **Theory and Fabrication of Solid State Devices.** Laboratory and lecture course on the physical theory, design, and fabrication of solid state devices; includes the electronic properties of semiconductors (such as mobility, carrier concentration, lifetime, energy gap), and techniques for fabricating (oxidation, diffusion, oxide masking, alloying) p-n junction devices. Prerequisite: Electrical Engineering 340. 4 hours or 1 unit.
346. **Hybrid Circuit Fabrication Laboratory.** Laboratory course on the basics of fabricating thin- and thick-film components as used in hybrid electronic circuits; experiments covering vacuum deposition, sputtering, anodization, resist processes, screen preparation, screen printing, and firing and trimming. Lectures provide background material and cover trade-offs of the two technologies. Prerequisite: Electrical Engineering 344. 2 hours or $\frac{1}{2}$ unit.
349. **Nonlinear Electronic Circuits.** Introduction to the elementary solution of zero, first-, and second-order differential-integral equations encountered in the study of electronic circuits; circuits used as examples employing uni- and bipolar transistors, unijunctions, tubes, and other devices; and emphasis on nonlinear negative resistance applications in switching applications and in oscillators of the relaxation and quasi-sinusoidal types. Prerequisite: Credit or concurrent registration in Electrical Engineering 342. 3 hours, or $\frac{3}{4}$ or 1 unit.
350. **Lines, Fields, and Waves.** Transmission lines, field calculations, and wave propagation. Prerequisite: Electrical Engineering 229 and 260. 3 hours or $\frac{3}{4}$ unit.
352. **Electromagnetic Fields.** Uniform plane waves, wave guides, radiation and propagation of electromagnetic energy, radiating systems, and electrodynamics. Prerequisite: Electrical Engineering 350. 3 hours or $\frac{3}{4}$ unit.
353. **Radio Communication Circuits.** Design of a radio system for transmission of information; types of receivers, matching techniques, receiver and antenna noise, types of modulation, high-frequency circuitry, and point-to-point and satellite communications. Prerequisite: Electrical Engineering 260; credit or concurrent registration in Electrical Engineering 350. 4 hours or 1 unit.
354. **Antennas.** Antenna parameters; polarization of electromagnetic waves; basic antenna types; antenna arrays; broadband antenna design; and antenna measurements. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 3 hours or 1 unit.
355. **Optical Electronics.** Optical beams and cavities; semiclassical theory of gain; charac-

- teristics of typical lasers; and application of optical devices. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 3 hours or 1 unit.
356. **Microwave Techniques.** UHF and microwave sources and detectors; laboratory techniques for UHF and microwave frequencies. Prerequisite: Credit or concurrent registration in Electrical Engineering 352 or 355. 1 hour, or 0 or $\frac{1}{4}$ unit.
357. **Radio Astronomy.** Same as Astronomy 357. Instrumental theory and observational techniques; radar and meteors; the moon and planets; solar radio waves; and galactic and extragalactic radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit.
359. **Introduction to Statistical Communication.** Introduction to random waveforms and noise; effects of noise on waveform and digital communications; and optimum receiver, matched filter, and signaling. Prerequisite: Electrical Engineering 266 and 310, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
361. **Introduction to Data Communication.** Introduction to principles of data communication between digital systems such as computers; basic concepts in modulation, source coding, channel capacity, and error-correcting codes; and communication networks. Prerequisite: Electrical Engineering 266 or equivalent. 3 hours or 1 unit.
366. **Aeronomy: Physics of the Upper Atmosphere and Space.** Same as Physics 366 and Astronomy 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmospheres; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; and experimental techniques. Prerequisite: Physics 342, 321, and 381, or consent of instructor. 4 hours or 1 unit.
367. **Active Networks.** Study of active device models and their application to electrical network equation forms; expression of systems in terms of their network functions; examination of the characteristics of feedback systems in particular; and examination of sensitivity and stability factors. Prerequisite: Electrical Engineering 342. 3 hours or $\frac{3}{4}$ unit.
368. **Solid-State Motor Drive Systems.** General principles of solid-state motor drives using silicon-controlled rectifiers and integrated circuits; discussion of drive systems and components including inverters, frequency converters, motors, generators, and control systems; and industrial applications. Prerequisite: Electrical Engineering 330 and 342. 3 hours or $\frac{3}{4}$ unit.
369. **Semiconductor Device and Linear IC Applications Laboratory.** Laboratory study of applications of unijunction transistors, silicon-controlled rectifiers, triacs, field effect transistors, and linear integrated circuits such as differential amplifiers, operational amplifiers, and linear communications integrated circuits. One hour of lecture and a three-hour laboratory each week. Prerequisite: Electrical Engineering 342. 2 hours or $\frac{1}{2}$ unit.
371. **Topics in Electrical Engineering.** Lectures and discussions relating to new areas of interest. Prerequisite: Specified by department or instructor. 0 to 4 hours, or 0 to 1 unit. May be repeated.
372. **Basic Aeronomic Processes.** Aeronomic aspects of gas kinetic theory; energy levels of atomic and molecular atmospheric species; emission and absorption bands and continua; atomic collision processes; chemical kinetics; photochemistry or oxygen allotropes and nitrogen and hydrogen oxides; transport mechanisms; plasma properties; and laboratory measurements. Prerequisite: Physics 381 or 383, or consent of instructor. 3 hours or 1 unit.
373. **Engineering Acoustics.** Same as Theoretical and Applied Mechanics 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems; vibrating string; vibrating membrane; plane waves; spherical waves; vibrating piston; acoustical filters; loudspeakers and microphones; principle of reciprocity; the ear; and architectural acoustics. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
374. **Ultrasonic Techniques.** Ultrasonic wave propagation, generation, detection, and measurement in liquid and solid media; acoustic impedance concepts; ultrasonic absorption

phenomena; piezoelectricity; and discussion of selected industrial, experimental, and bioengineering applications with laboratory demonstrations. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Mathematics 345. 3 hours or 1 unit.

376. **Symmetrical Component Analysis of Power Systems.** Representation of power systems; symmetrical component; positive, negative, and zero sequence impedances of network components; sequence networks; unsymmetrical faults; unsymmetrical power systems; and matrix algebra in symmetrical component analysis. Prerequisite: Senior standing. 3 hours, or 0 or 1 unit.
378. **Electric Power Networks.** Steady-state power network analysis; inductive coordination; transmission line capacitance and resistance; networks synthesis; and application of computers to power network problems. Prerequisite: Senior standing. 3 hours, or 0 or 1 unit.
379. **Pulse and Digital Laboratory.** Laboratory to accompany Electrical Engineering 380. Prerequisite: Credit or concurrent registration in Electrical Engineering 380. 1 hour or $\frac{1}{4}$ unit.
380. **Pulse and Digital Circuits.** Analysis and design of circuits in which nonlinearities of the active devices are a significant factor or in which the signals are primarily pulses; generation, transmission, and processing of such signals appropriate for small-scale instrumentation as well as to large systems such as computers. Prerequisite: Electrical Engineering 260, 340, and 290; credit or concurrent registration in Electrical Engineering 379, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Principles and Application of Linear Integrated Circuits.** Techniques of analysis and synthesis of linear integrated circuits, concentrating on linear integrated circuit biasing systems, building blocks, differential amplifiers, operational amplifiers, and integrated circuits used in communications; analysis of integrated circuits by hand calculations and by specialized computer analysis programs. Prerequisite: Electrical Engineering 342. 3 hours or $\frac{3}{4}$ unit.
385. **Theory of Semiconductor Computer Devices.** Same as Computer Science 385. Crystal conduction; large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology: masking, oxidizing, and etching; and emphasis on development of device-theoretical background for computer logic design. Prerequisite: Electrical Engineering 294 or Computer Science 294, and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Control Systems, I.** Analysis and design of control systems with emphasis on modeling, state variable representation, computer solutions, modern design principles, and laboratory techniques. Prerequisite: Electrical Engineering 310 or consent of instructor. 4 hours or 1 unit.
387. **Introduction to Quantum Electronics for Electrical Engineers.** Introduction for the senior electrical engineering student to the application of quantum mechanical concepts to electronics problems; specifically, application of elementary quantum mechanics to the detailed study of a calculable two-state laser system; and incidental quantum ideas bearing on electronics. Prerequisite: Physics 383 or consent of instructor. 3 hours or 1 unit.
388. **Electronic Analog Computers.** Design of analog computer elements; problem preparation and representative solutions of physical problems. Prerequisite: Electrical Engineering 342 and Mathematics 345, or consent of instructor. 3 hours, or 0 or 1 unit.
389. **Digital Computer Circuit Design.** Same as Computer Science 389. Design of switching circuits and systems taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data-handling links; and consideration of component tolerance, circuit reliability, and cost factors. Prerequisite: Computer Science 264 or Electrical Engineering 290 and either Computer Science 281 or Electrical Engineering 340. 3 hours or 1 unit.

390. **Introduction to Optimization.** Same as Mathematics 390. Basic theory and methods for the solution of optimization problems; iterative techniques for unconstrained minimization; and introductory presentation of linear and nonlinear programming with engineering applications. Prerequisite: Computer Science 101 or Mathematics 343, or consent of instructor. 3 hours or 1 unit.
391. **Switching Theory.** Same as Computer Science 391 and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Computer Science 392 and Mathematics 392. Synchronous machines: state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines: state assignment, hazards, and interacting machines. Prerequisite: Mathematics, Electrical Engineering, or Computer Science 391. 3 hours or 1 unit.
394. **Introduction to Computer Arithmetic.** Same as Computer Science 394. Review of binary number representations, logical design of adders and arithmetic units, and simple multiplication and division methods; multiplier recoding; redundant division methods; design of carry-save adders and signed-digit arithmetic units; and case studies of high-speed arithmetic units. Prerequisite: Computer Science 264. 3 hours or 1 unit.
395. **Control Structure of Computers.** Same as Computer Science 395. Asynchronous, synchronous, and microprogrammed control structures in the framework of computer architecture; interlocking of autonomous subcontrols; and case studies in typical control features: instruction look-ahead, multiprocessing interrupt, and input/output. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 391 and Computer Science 201, or consent of instructor. 3 hours or 1 unit.
397. **Projects and Lectures in Quantum Electronics.** Study of processes involving quantum mechanical energy transfers in energized media leading to various lasering devices and their applications. A series of lectures, supplementing the special projects, offers background information on spectroscopy, collisional energy transfer, laser pumping schemes, modulation at optical frequencies, holography, and other related topics. Prerequisite: Senior standing; consent of instructor; Electrical Engineering 387 recommended. 3 hours, or 0 to 1 unit.
400. **Seminar.** Required of all graduate students. 0 credit.
414. **Engineering Applications of Linear Graphs.** Same as Computer Science 414. Elementary theory of linear graphs; Euler graphs; incidence, cut-set, and circuit matrices and their properties; realizability of cut-set, circuit, and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; and communication networks. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318. 1 unit.
415. **Control System Theory and Design.** Synthesis of feedback control systems to meet design specifications, including sensitivity; multivariable systems; introduction to systems with random inputs; state variable techniques; and nonlinear systems. Prerequisite: Electrical Engineering 386 or equivalent, or consent of instructor. 1 unit.
416. **Analysis of Networks and Systems.** Dynamic equations of linear lumped networks and systems; time-domain analysis and state space methods; frequency-domain analysis and transform methods; stability criteria; and applications to various problems in electrical engineering. Prerequisite: Credit or concurrent registration in Mathematics 346 or 348; Electrical Engineering 310. 1 unit.
418. **Electric and Magnetic Fields.** Rigorous treatment of basic laws, static fields, typical field systems, harmonic functions, conjugate functions, and conformal transformation. 1 unit.
420. **Electromagnetic Waves and Radiating Systems.** Fundamental electromagnetic theory with applications to transmission lines, waveguides, and antennas; introduction to the solution of advanced problems in static electric and magnetic fields. Prerequisite: Electrical Engineering 352. 1 unit.

421. **Advanced Electromagnetic Engineering.** Reciprocity and equivalence principles; formulation of scattering and diffraction problems; approximations for large and for short wavelengths; plane, cylindrical, and spherical wave problems; variational methods; Wiener-Hopf techniques; and applications to antennas and waveguide problems. Prerequisite: Electrical Engineering 420. 1 unit.
422. **Controlled Fusion Systems.** Same as Nuclear Engineering 422. Development of plasma models for fusion analysis; treatment of plasma heating and confinement with applications to current experiments; and energy balances and energy extraction, minimum beta configuration, instability criteria, Tokamak machines, pinch systems, and mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
423. **Gaseous Electronics and Plasmas.** Basic concepts and techniques, both theoretical and experimental, which are used in the areas of gaseous electronics, gas and solid plasmas, controlled fusion, aeronomy, gas lasers, and magnetohydrodynamics. Prerequisite: Physics 383 or Electrical Engineering 352, or equivalent, or consent of instructor. 1 unit.
425. **Nuclear-Electrical Energy Conversion.** Same as Nuclear Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection; analysis and applications of direct collection of charged particles; and radiation-induced ionization and excitation theory and application. 1 unit.
428. **Analysis of Nonlinear Systems.** Same as Theoretical and Applied Mechanics 428. Treatment of singular points and stability considerations; consideration of graphical and analytical methods, including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
431. **Theory of Guided Waves.** Propagation in general cylindrical waveguides; eigenvalue problems, stationary principles, microwave circuit theorems, boundary value problems, and the determination of circuit parameters; and periodically loaded waveguides with anisotropic media. Prerequisite: Electrical Engineering 420. 1 unit.
432. **Compound Semiconductors (Optical Devices).** Properties of III-V and II-VI compound semiconductors and the devices which are unique to these materials; emphasis on materials such as GaAs, Ga(AsP), GaP, CdSe, Cd(SeS), etc., and on luminescence, semiconductor lamps, and semiconductor lasers. Prerequisite: Graduate standing in electrical engineering with some background in modern physics; elementary quantum mechanics; elementary semiconductor theory or equivalent. 1 unit.
434. **Random Processes and Linear Filtering.** Basic concepts of random processes; spectral analysis; linear systems with random inputs; and applications of random processes in communications and control theory: parameter estimation and linear filtering. Prerequisite: Mathematics 361 or equivalent, or Electrical Engineering 359. 1 unit.
435. **Theory of Semiconductors and Semiconductor Devices.** Same as Physics 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high-frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; and characteristics of p-n junctions, heterojunctions, and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
437. **Principles of Microwave Measurements.** Generation and detection of the laboratory signal; the generalized impedance concept; matrix representation of waveguide discontinuities; determination of equivalent network parameters; analysis of measurement techniques by signal flow graphs; and accuracy criteria. Prerequisite: Electrical Engineering 355 and 356. 1 unit.
439. **Advanced Theory of Semiconductors and Semiconductor Devices.** Continuation of Electrical Engineering 435. Selected advanced topics of current interest in the physics of semiconductors and solid-state devices. Prerequisite: Electrical Engineering 435. 1 unit.

440. **Advanced Power Circuit Analysis, I.** Analysis of power systems by symmetrical and related components; equivalent circuits of lines, transformers, and machines; fault calculations on symmetrical and unsymmetrical power systems; and the network analyzer in fault studies. 1 unit.
444. **Introduction to Artificial Intelligence.** Same as Computer Science 444. Introduction to basic concepts in artificial intelligence with emphasis on computer understanding of natural language concepts; formal representations of natural language concepts, data structure, and list processing; linguistic analysis including both syntactic and semantic processing; automatic logic deduction and theorem proving; and survey of applications to systems including question answering, information retrieval, and problem solving. Prerequisite: Consent of instructor. 1 unit.
445. **Power System Stability.** Transient and steady-state stability in power systems; power flow equations; transient stability swing curves; critical clearing time; the network analyzer in stability studies; and the analog computer in transient stability studies. Prerequisite: Electrical Engineering 440. 1 unit.
451. **Advanced Network Synthesis.** Active network synthesis; sensitivity of networks; and scattering matrix, broad band matching, computer-aided design of filters, and matching networks. Prerequisite: Electrical Engineering 324 or equivalent; credit or concurrent registration in Mathematics 346. 1 unit.
452. **Time-Varying and Nonlinear Circuits.** Energy considerations; equations in normal form; frequency power relations in nonlinear networks; frequency conversion; Lyapunov's direct method; the circle stability criterion; and calculus of variations and Hamilton's principle applied to the stability and matching problems. Prerequisite: Electrical Engineering 416; Mathematics 346. 1 unit.
453. **Optimum Control Systems.** Formulation of the optimization problem; controllability; observability; stability; Lyapunov's second method; application of variational calculus, maximum principle, and principle of optimality to control problems; stochastic control; and adaptive control. Prerequisite: Electrical Engineering 415. 1 unit.
454. **Sampled-Data Control Systems.** Analysis and design of feedback control systems with digital and sampled data. Prerequisite: Electrical Engineering 415 or equivalent. 1 unit.
456. **Coding Theory.** Same as Computer Science 456. General discussion on coding theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; and applications to computers and data-transmission systems. Prerequisite: Mathematics 317 or equivalent, or consent of instructor. 1 unit.
463. **Information Theory.** Same as Computer Science 463 and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361 or equivalent. 1 unit.
465. **Topics in Automata Theory.** Same as Computer Science 465 and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. Prerequisite: Electrical Engineering 392 or consent of instructor. 1 unit.
468. **Advanced Solid-state Electrical Energy Conversion Systems.** Principles of solid-state electrical energy conversion systems; emphasis on the theory and operation of various types of inverters, converters, and cycloconverters; and applications including uninterrupted computer power supplies, electric automobiles, trucks, locomotives, earth-moving equipment, off-highway vehicles, industrial automation, and power system distribution. Prerequisite: Graduate standing. 1 unit.
470. **Nonlinear Optics.** Light propagation in anisotropic crystals; second- and third-order nonlinear susceptibility and electro-optic effect; and discussion of the relationship of these effects along with such applications as light modulation, harmonic generation, and optical parametric amplification and oscillation. Prerequisite: Electrical Engineering 420. 1 unit.
472. **Quantum Electronics.** Brief theoretical introduction to quantum mechanics and atom-

ic physics, with many applications in spin resonance and modern maser theory. Prerequisite: Physics 381; Physics 362 and 385 recommended. 1 unit.

475. **Ionospheric Radio Propagation.** Propagation in a stratified medium; WKB solution; ray theory; ionospheric sounding; ionospheric transmission problems; scattering by irregularities; propagation in a random medium; cross-modulation and nonlinear effects; magneto-ionic theory; Faraday effect; whistler propagation; coupling of characteristic waves; magnetohydrodynamic waves; formation of ionospheric E-region; and formation of F-region. Prerequisite: Electrical Engineering 420 or equivalent. 1 unit.
477. **Advanced Antenna Theory.** Selected topics from recent engineering literature on antennas supplemented by advanced topics in electromagnetic theory needed for comprehension; current techniques for analysis of wire, slot, horn, frequency independent, quasi-optical, and array antennas. Prerequisite: Electrical Engineering 420. 1 unit.
482. **Theory of Digital Computer Arithmetic.** Same as Computer Science 482. Emphasis on the use of redundancy in the representation of digits in order to increase the efficiency of computer arithmetic; topics include multiplier recoding, division with redundantly represented quotients, and structural redundancy as implied by carry-save and signed-digit techniques. Prerequisite: Computer Science 394 or Electrical Engineering 394. 1 unit.
485. **Advanced Theory of Magnetic and Optic Computer Memory Devices.** Same as Computer Science 485. Theory of ferromagnetism and superconductivity applied to memory devices; light propagation in anisotropic media; modulators and deflectors; and principles of laser operation. Prerequisite: Electrical Engineering 385. 1 unit.
486. **The Constitution and Behavior of the Upper Atmosphere.** Same as Astronomy 486. Chemical and dynamical processes in the upper atmosphere; emphasis on the processes by which emitted solar energy is transformed and the resulting behavior of the atmosphere and ionosphere. Prerequisite: Electrical Engineering 371 or consent of instructor. 1 unit.
488. **Experimental Techniques in Aeronomy.** Principles and typical results of measurement techniques for studies of the neutral and ionized constituents of the earth's upper atmosphere; radio techniques, probes, mass spectrometers, photometers, and particle detectors. Prerequisite: Graduate standing in electrical engineering or physics. 1 unit.
490. **Seminar in Special Topics.** Lectures and discussions on current research and literature on advanced topics in electrical engineering. Prerequisite: Advanced standing; consent of instructor. 0 to 1/2 unit. May be repeated for credit.
497. **Electrical Engineering Problems.** Lectures and discussions relating to new areas of interest. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated for credit.
498. **Individual Study.** Individual projects. Prerequisite: Consent of instructor. 1/2 to 2 units.
499. **Thesis Research.** 0 to 4 units.

ELEMENTARY EDUCATION

Chairman of Department: Professor J. D. Rath

Department Office: 306 Education Building, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
230. **Principles, Problems, and Issues in Elementary Education.** Focuses on the problems and issues facing the classroom teacher in curriculum development, planning, and evaluation; develops and applies of educational principles which serve to guide the teacher in dealing with these problems and issues. Prerequisite: Concurrent registration in Educational Practice 232. 3 hours.
233. **Classroom Programs in Childhood Education.** Organizing balanced daily programs in

- childhood education; planning and using materials of instruction; and evaluating pupil achievement. Prerequisite: Junior standing; Educational Psychology 236. 2 hours.
237. **Theory and Process in Elementary School Teaching.** Directed toward affecting prospective teacher insight with regard to classroom behavior in teaching; includes materials dealing with the factors of child learning, teaching theory, and elementary school curriculum; and a six-week morning assignment to a public school classroom is part of the course structure. Prerequisite: Educational Psychology 236. 5 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
331. **Teaching Social Studies in the Elementary School.** Emphasis on the role of social education in the elementary school; the formal instructional program in social studies, including the knowledge, skills, and sensitivities to be taught; the teaching strategies and materials employed; and the organization of learning experiences and the total program in addition to the educative impact of the elementary school as a social system. Prerequisite: Elementary Education 237; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
332. **Principles and Practices in Elementary Mathematics Education.** Organization, scope, and sequence of the elementary mathematics program and the functional nature of mathematics; methods, techniques, experiences, and materials of value in teaching elementary mathematics, and the role of classroom teacher. Prerequisite: Mathematics 202 and 203, or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
333. **The Teaching of Language Arts in the Elementary School.** Goals, content, and teaching problems involved in the devising of programs in the area of elementary school language arts that are cumulative and sequential from kindergarten through the elementary school. Prerequisite: Elementary Education 237; Educational Psychology 236. 3 hours, or $\frac{1}{2}$ to 1 unit.
334. **Principles and Practices in Early Childhood Education.** Study of the principles and practices of using play as an educational tool in early childhood education; review of historical, philosophical, and psychological foundations of nursery-kindergarten methods; assessment of techniques relating play to various aspects of instruction; survey of materials and equipment; and presentation of methods of classroom evaluation. Prerequisite: Elementary Education 237. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **Science in the Elementary School.** The principles, place, and practice of science education in the elementary school and in the lives of children; stress on the functional nature of science and its place in the curriculum; and consideration given to the organization of the science program, experiences and techniques of value in teaching, and of the role of the classroom teacher and specialist. Opportunity for experience in field and laboratory work. Prerequisite: Elementary Education 237 or equivalent; two years of college science. 3 hours or $\frac{1}{2}$ unit.
336. **Fundamentals of Reading Techniques.** Same as Secondary Education 336. Basic principles, techniques, and materials for the developmental reading program; emphasis on methods and materials which provide for differentiated instruction. Prerequisite: Junior standing; registration in a teacher education curriculum. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Art Education in the Elementary School.** Methods, plans, and materials for teaching art as an integral part of the total educational program in the elementary school. Prerequisite: Junior standing. 3 hours or $\frac{1}{2}$ unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Secondary Education 338. Developmental reading programs beyond the primary grades; factors related to reading speed and comprehension; and vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Educational Psychology 211; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.

- 339. Corrective Reading.** Same as Educational Psychology 339. Practice in administering and interpreting group diagnostic reading tests; presentation of instructional techniques appropriate for less severe reading disabilities. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.
- 348. Speech and Language Clinical Methods in the Schools.** Same as Speech and Hearing Science 348. Study of methods and materials used in the schools by the speech and language clinician. Prerequisite: Speech and Hearing Science 388. 3 hours or $\frac{1}{2}$ unit.
- 354. Audio-Visual Communication.** Same as Library Science 354 and Secondary Education 354. Analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 431. Elementary School Classroom Programs.** Exploration of organizational centers for determining selection and sequence of educative experiences in the elementary school classroom; emphasis on the role of the teacher in curriculum construction. 1 unit.
- 432. Clinical Diagnosis and Remediation in Reading.** Supervised experience in the reading center; special attention to evaluative and interpretative techniques in cases of severe reading disabilities based on the analysis of specific reading needs. Prerequisite: Elementary Education 339; a course in individual mental testing. 1 unit. May be repeated for a maximum of 2 units.
- 433. Curriculum Problems and Trends in Special Fields of Elementary Education.** Study of the place of the various special fields of elementary education in the emerging elementary school curriculum, with a review and analysis of recent trends and research findings in these fields. Sections are usually offered in the following fields: (a) language arts; (b) social studies; (c) mathematics; (d) science; (e) creative arts; (f) reading; (g) early childhood education; (h) teacher education; and (i) open education. Prerequisite: For all sections, Elementary Education 431 or 434, or consent of instructor; for the section in language arts, Elementary Education 333 and 336, or a course in the teaching of reading or language arts, or consent of instructor; for the section in creative arts, Elementary Education 337 or consent of instructor; for the section in science, Elementary Education 335 or a methods course in teaching science in the elementary school and two years of college science, or consent of instructor; for the section in reading, Elementary Education 336 or a course in teaching of reading, or consent of instructor; for the section in early childhood education, Elementary Education 434 or consent of instructor. 1 unit.
- 434. Programs in Early Childhood Education.** Advanced course intended primarily for teachers and supervisors of younger children, ages three to eight; review and analysis of research findings, experimentation, and current trends in curriculum organization, procedures, and materials essential to developing classroom programs for children. 1 unit.
- 435. Diagnosis and Correction in Elementary Mathematics.** The nature, causes, and correction of mathematical difficulties at the elementary level; process of evaluation through group and individual procedures; the development and use of diagnostic instruments and corrective techniques; and supervised experience with pupils having difficulties. Prerequisite: Elementary Education 332 and Educational Psychology 392, or equivalent. 1 unit. May be repeated for a maximum of 2 units.
- 436. Field Instruction in Reading Programs.** Directed practice in the area of reading; students are placed in an approved and supervised field position for part of the semester. Prerequisite: Elementary Education 432. 1 unit.
- 437. Methods of Child Study.** Study of ways in which teachers can evaluate child behavior and development with emphasis on classroom application; instruction and practice in the use and interpretation of observations, anecdotal records, rating scales, interviews, achievement tests, intelligence tests, questionnaires, and sociometric and projective techniques. Prerequisite: Educational Psychology 312 or consent of instructor. 1 unit.

438. **The Organization and Supervision of School Reading Programs.** Study of procedures for planning, improving, and evaluating reading programs on a system-wide basis. Open only to those persons who are preparing to supervise reading programs or with approval of graduate adviser. Prerequisite: Elementary Education 339; Elementary Education 433 (reading section). 1 unit.
439. **Fundamentals of Curriculum Development.** Designed to explore and clarify the several theoretical bases offered in educational literature for each of the major aspects of curriculum planning; to indicate the forms implementation of these theories have assumed in practice; to reduce these theoretical and practical differences to fundamental issues; to encourage critical evaluation of both the theories and practices; and to project, on the basis of such analysis, needed research, present best practice, and ultimately desirable programs. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student, and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
455. **Theories of Art Education.** Study of the major theories of art education and an analysis of the most significant research in the field; emphasis given to a critical evaluation of theory and research and to the application of such studies to current problems in art education in the public schools. Prerequisite: Elementary Education 337 or Secondary Education 456, or consent of instructor. 1 unit.
459. **Workshop in Curriculum Development.** Curriculum development projects in specialized fields of elementary education. 1 to 2 units.
483. **Seminar in Literary Criticism and the Teaching of English.** Same as English 483 and Secondary Education 483. Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
490. **Seminar for Advanced Students of Education.** Seminar in elementary education open only to persons who have been admitted for doctoral study in elementary education. 0 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems. Each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

ENGINEERING

Program Administrator: Professor H. L. Wakeland

Program Office: 207 Engineering Hall, Urbana

100. **Engineering Lecture.** Engineering lecture for freshmen; selected topics each week. Required of freshmen in the College of Engineering. 0 credit.
101. **Cooperative Engineering Education Seminar.** Discussion seminar which gives an introduction to cooperative engineering education. Topics discussed include duties and responsibilities of the student; duties and responsibilities of the cooperative employer; and techniques for obtaining maximum benefits from the program. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.

102. **Cooperative Engineering Education Practice.** Off-campus practice of engineering in government or industry. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
299. **Engineering Study Abroad.** Provides campus credit for foreign study and/or provides a mechanism for engineering students to maintain continuous enrollment on this campus. If objective is study abroad for credit, a detailed proposal must be submitted by the student for approval by a committee of the department in which the student is studying and the college office prior to such study abroad. Final determination of credit and its application toward the student's degree is made after a review of the student's work abroad by the above committee and the college office. Prerequisite: Completion of sophomore year in engineering; approval of student's proposed study program by his department and the college office. 0 to 15 hours (summer session, 0 to 7 1/2 hours).

ENGINEERING HONORS

Executive Secretary of Program: Professor R. W. Bokenkamp
Program Office: 207 Engineering Hall, Urbana

196. **The Engineer and Society.** Prerequisite: Freshman James Scholar. 2 hours.
197. **The Engineer and His Profession.** Introduction to the nature of science and engineering, and the attributes of a scientist and an engineer. Prerequisite: Freshman James Scholar. 1 hour.
198. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester for freshman James Scholars to enable them to explore at their own level various aspects of technology that are of interest to them. Prerequisite: Honors student in the University. 1 to 4 hours.
297. **College Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester in special interdisciplinary subjects of current interest for James Scholars in engineering. Prerequisite: James Scholar in engineering or consent of instructor. 1 to 4 hours.

ENGLISH

(Including Business and Technical Writing and Rhetoric and Composition)

Head of Department: Professor G. Hendrick
Department Office: 100 English Building, Urbana

Business and Technical Writing

199. **Undergraduate Open Seminar.** 0 to 9 hours.
251. **Business and Administrative Communication.** Study of communication as a tool of administration and management; practice in writing a wide variety of types and forms of communication; and inclusion of oral and visual communication with the written to provide an integrated approach. For the student whose career will be in administration and management requiring a broad range of communication skills. Prerequisite: Fulfillment of the campus rhetoric requirement, or consent of instructor. 3 hours.

271. **Sales Writing.** Same as Advertising 288. Direct mail campaigns and company magazine copy. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
272. **Report Writing.** Personal direction in a report writing project which can be integrated with research in another course; study of report-writing principles and practices. Classes meet for the first month after which the student and the instructor arrange a conference schedule. Small group meetings are arranged for presentation of proposals, progress reports, and summary reports. Prerequisite: Fulfillment of campus rhetoric requirement. 3 hours.
293. **Independent Study.** Independent research with a chosen tutor leading to the writing of a formal report or preparation of some other type of major presentation of information. Prerequisite: Completion of campus freshman rhetoric requirement. 3 hours.

English

101. **Introduction to Poetry.** Reading and discussion of representative poems of several periods and types. 3 hours.
102. **Introduction to the Drama.** Reading and discussion of representative plays of several periods and types. 3 hours.
103. **Introduction to Fiction.** Reading and discussion of representative fiction of several periods and types. 3 hours.
106. **Literature and Experience.** Understanding of the relationship between literature and human experience through the study of significant, recurrent themes. 3 hours. May be repeated to a total of 6 hours.
115. **Masterpieces of English Literature.** Study of selected major writings. 3 hours.
116. **Masterpieces of American Literature.** Study of selected major writings. 3 hours.
195. **Freshman Honors Seminar, I.** Introduction to the study of literature, with emphasis on individual work in fundamental problems of literary analysis, chiefly of short fiction and nondramatic poetry. Prerequisite: James Scholar standing or other designation as a superior student. This course will fulfill the Group I, criticism, requirement for the English major. 4 hours.
196. **Freshman Honors Seminar, II.** Continuation of English 195, with emphasis on the applicability of classification according to literary mode in solving the fundamental problems of criticism. Prerequisite: English 195 and James Scholar standing or other designation as a superior student. This course will fulfill the Group I, criticism, requirement for the English major. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Literary Analysis and Evaluation.** Study and practice in intensive critical analysis with attention to several critical methods. 3 hours.
202. **Medieval Literature and Culture.** British and continental authors (including Chaucer) read in modern English. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
204. **Renaissance Literature and Culture.** Readings in English and continental literary masterpieces with attention to the significant cultural influences of the period. 3 hours.
205. **Introduction to Shakespeare.** 3 hours.
206. **Literature and Culture of the Enlightenment.** Readings in English and continental literature of the eighteenth century, with attention to significant cultural influences. 3 hours.
207. **Nineteenth-Century Literature and Culture.** English and continental literature of the nineteenth century, with attention to major intellectual and social movements. 3 hours.
209. **English Literature from the Beginning to 1798.** Historical and critical study of selected works of English literature to 1798 in chronological sequence. 3 hours.
210. **English Literature from 1798 to Present.** Historical and critical study of selected works of English literature after 1798 in chronological sequence. 3 hours.

240. **The English Romantic Poets.** Wordsworth, Scott, Coleridge, Byron, Shelley, and Keats. 3 hours.
241. **The Beginnings of Modern Poetry.** American and British poets including Frost, Robinson, Sandburg, Lindsay, Hardy, Hopkins, Housman, Yeats, Lawrence, the imagists, and the early Pound and Eliot. 3 hours.
242. **Poetry Since 1940.** 3 hours.
243. **Development of the Modern Drama.** Ibsen to O'Neill. 3 hours.
244. **Development of the Modern Drama.** Pirandello to the present. 3 hours.
245. **The Short Story.** Historical and critical study of the short story (American and European) from the early nineteenth century to World War I; major emphasis on such authors as Hawthorne, James, Crane, Gogol, Chekhov, Maupassant, Flaubert, Joyce, and Mansfield. Prerequisite: One course in English or American literature. 3 hours.
246. **The Short Story.** Historical and critical study of the short story (American and European) from World War I to the present; major emphasis on such authors as Anderson, Hemingway, Faulkner, Porter, Mann, Kafka, Maugham, Lawrence, Salinger, and Camus. Prerequisite: One course in English or American literature. 3 hours.
247. **The British Novel.** Critical study of representative British novels from different literary periods. 3 hours.
248. **The European Novel.** Thematic interrelationships and contemporary relevance of such writers as Gogol, Turgenev, Dostoevsky, Flaubert, Tolstoy, Zola, Mann, Hesse, Kafka, and Camus. 3 hours.
249. **The American Novel.** Study of major and representative novels from the beginnings to the present. 3 hours.
255. **Survey of American Literature, I.** American literature and its cultural backgrounds to 1900. 3 hours.
256. **Survey of American Literature, II.** American literature and its cultural backgrounds in the twentieth century. 3 hours.
259. **Afro-American Literature, I.** Historical and critical study of Afro-American literature in its social and cultural context from the beginning to 1915. 3 hours.
260. **Afro-American Literature, II.** Historical and critical study of Afro-American literature in its social and cultural context since 1915. 3 hours.
273. **Film as Literature.** 3 hours.
274. **Literature in its Cultural Contexts.** Studies of literature from the point of view of other disciplines; topics to be announced. 3 hours.
275. **Literature and Psychology.** Psychological and psychoanalytical theories in their bearings on the interpretation of literature. 3 hours.
293. **Independent Study.** Study of selected topics. Prerequisite: Consent of instructor. 0 to 3 hours. May be repeated for a total of 6 hours. Students may register in this course more than once in the same term.
295. **Honors Seminar, I: Themes, Movements, and Forms in British and American Literature.** Restricted to English and English education majors with a grade-point average of 4.25; enrollment through the English Honors Office necessary. Offered every semester with varying topics; may be repeated as topic varies. 3 hours.
296. **Honors Seminar, II: Periods in British and American Literature.** Restricted to English and English education majors with a grade-point average of 4.25; enrollment through the English Honors Office necessary. Offered every semester with varying topics; may be repeated as topic varies. 3 hours.
297. **Honors Seminar, III: Major British and American Authors.** Each seminar considers one or two major authors. Restricted to English or English education majors with a grade-point average of 4.25; enrollment through the English Honors Office necessary. 3 hours.
298. **Senior Honors Tutorial.** Independent research with a chosen tutor leading to the writing of a thesis. Candidates for distinction in English must take either English 293 or English 298; they may take both. Restricted to English or English education majors

with a 4.25 average who have satisfied all other requirements towards the degree with distinction; enrollment in the English Honors Office necessary. 3 hours.

301. **Introduction to the Study of the English Language.** Language theories and modes of language study applied to English. 3 hours or 1 unit.
302. **Descriptive English Grammar.** Same as English as a Second Language 302. 3 hours or 1 unit.
303. **Historical Introduction to the English Language.** Credit is not given for both English 303 and 403. 3 hours or 1 unit.
311. **Chaucer.** A selection read in Middle English. 3 hours or 1 unit.
315. **Poetry and Prose of the English Renaissance, 1500-1600.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
316. **Tudor Drama Exclusive of Shakespeare.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
317. **Spenser.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
318. **Shakespeare, I.** Earlier tragedies, comedies, and history plays. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
319. **Shakespeare, II.** Mature tragedies, dark comedies, and late romances. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
321. **Poetry and Prose from the Metaphysicals to 1660.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
322. **English Drama, 1603-42.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
323. **Milton.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
325. **English Literature of the Restoration.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
326. **English Literature of the Early Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
327. **English Literature of the Later Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
328. **English Drama of the Restoration and Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
329. **Restoration and Eighteenth-Century Fiction.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
331. **English Romantic Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
333. **Early Victorian Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
334. **Later Victorian Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
335. **Nineteenth-Century British Fiction.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
341. **British Literature in the Twentieth Century to 1930.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
342. **British Literature in the Twentieth Century Since 1930.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
343. **The Plays of Bernard Shaw.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
346. **American Literature of the Colonies and Early Republic.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
347. **Literature of the American Renaissance.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.

350. **American Literature from the Civil War to the First World War.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
351. **American Literature from the First World War to the Present.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
355. **Major Authors.** Intensive study of the work of one or two major authors. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
361. **Topics in English Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once as topic varies.
362. **Topics in American Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
363. **Special Topics in the Study of Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
364. **Tragedy.** History and theory of stage tragedy. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
365. **Comedy.** History and theory of stage comedy. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
366. **Topics in Modern Drama.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
367. **The International Folk Tale.** Same as Comparative Literature 359. Origin, nature, and distribution of the folk tale. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
368. **The Ballad and Folksong in the United States.** English-language traditional songs and ballads, transplanted and native. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
370. **Vladimir Nabokov.** Same as Russian 370 and Comparative Literature 370. The major contribution of Vladimir Nabokov to world literature. No knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
375. **Topics in the Relation of Other Disciplines to the Study of Literature.** Topics to be announced. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once as topic varies.
381. **Theory and Practice of Written Composition.** History and theory of written composition; basic rhetorical principles; and guidance and criticism of student writing. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
382. **Literary Criticism from Plato to 1800.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
383. **Literary Criticism from 1800 to the Present.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
385. **Literature for the High School.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
387. **Introduction to the Methodology of Myth and Folklore.** Same as Comparative Literature, German, and Slavic 394, and Speech Communication 346. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
400. **Introduction to Research and Critical Techniques.** Introductory course in methods and techniques in research and literary criticism; strongly recommended for all students seeking the Ph.D. 1 unit.
403. **History of the English Language.** Study of the development of the language from the earliest stages to the present. Credit is not given for both English 403 and 303. 1 unit.
404. **Seminar in the English Language.** Prerequisite: Consent of instructor. 1 unit.
407. **Old English.** Introduction to the language before 1000 A.D. 1 unit.
408. **Beowulf.** Prerequisite: English 407 or consent of instructor. 1 unit.
409. **Old English Literature and Its Cultural Background.** Prerequisite: English 407 or consent of instructor. 1 unit. May be repeated as topic varies.
410. **Middle English.** Introduction to Middle English dialects, with emphasis on the East Midland. Prerequisite: Consent of instructor. 1 unit.

411. **Chaucer: Troilus and Crisedye and the Minor Poems.** 1 unit.
412. **Chaucer: The Canterbury Tales.** 1 unit.
413. **Middle English Literature and Its Cultural Background.** 1 unit. May be repeated as topic varies.
414. **Seminar in Medieval Literature.** Prerequisite: A college course devoted entirely to an aspect of medieval studies, or consent of instructor. 1 unit. May be repeated as topic varies.
419. **Seminar in Shakespeare.** Prerequisite: A college course devoted entirely to an aspect of Shakespeare's work, or consent of instructor. 1 unit. May be repeated as topic varies.
420. **Seminar in Sixteenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
424. **Seminar in Seventeenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
427. **Seminar in Restoration and Eighteenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of eighteenth-century studies, or consent of instructor. 1 unit. May be repeated as topic varies.
433. **Seminar in Romantic Literature.** Same as Comparative Literature 452. Prerequisite: A college course devoted entirely to an aspect of romantic studies, or consent of instructor. 1 unit. May be repeated as topic varies.
437. **Seminar in Victorian Literature.** Prerequisite: A college course devoted entirely to an aspect of Victorian studies, or consent of instructor. 1 unit. May be repeated as topic varies.
443. **Seminar in Modern British Literature.** Prerequisite: One college course devoted entirely to an aspect of modern British studies, or consent of instructor. 1 unit. May be repeated as topic varies.
447. **Seminar in Earlier American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
453. **Seminar in Later American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
463. **Seminar in Literary Themes and Movements.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
464. **Seminar in Literary Modes and Genres.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
469. **Seminar in the Stage History of Classic English Plays.** Same as Speech Communication 469 and Theatre 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history, or consent of instructor. 1 unit.
478. **Seminar in the Relation of Other Disciplines to the Study of Literature.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
481. **Seminar in Literary Theory and Criticism.** Prerequisite: A college course devoted entirely to criticism, or consent of instructor. 1 unit. May be repeated as topic varies.
483. **Seminar in Literary Criticism and the Teaching of English.** Same as Elementary Education 483 and Secondary Education 483. Prerequisite: One year of college study of literature, or consent of instructor. 1 unit. May be repeated as topics varies.
487. **Seminar in the Teaching of English.** Prerequisite: One year of college study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
489. **Seminar in Bibliographical Method.** Same as Library Science 400. 1 unit.
491. **Research in Special Topics.** Independent study under the guidance of a member of the graduate faculty. 1 unit. May be repeated for a total of 2 units.

492. **General Examination Tutorial.** Reading for the general examination under the guidance of a member of the graduate faculty. Prerequisite: Doctoral standing. 1 unit. May be repeated for a total of 2 units taken concurrently or in a sequence.
493. **Professional Seminar in the Teaching of College English.** Prerequisite: Doctoral candidate standing or consent of instructor. 1 unit. May be repeated as topic varies.
499. **Thesis Research.** Guidance in writing theses for doctoral degrees. Prerequisite: Doctoral candidate standing. 0 to 4 units.

Rhetoric and Composition

103. **Writing Laboratory.** Intensive tutoring in basic writing skills to be scheduled at the Writing Laboratory. Prerequisite: Concurrent registration in Rhetoric 104 or 105, or Speech Communication 111 or 112, or written consent from the English Undergraduate Office. 1 hour. May be repeated for a total of 2 hours.
104. **EOP Rhetoric.** An introductory writing course designed for EOP students and with concentration on exposition; must be taken concurrently with Rhetoric 103, a 1-hour course offered at the Writing Laboratory. 3 hours.
105. **Principles of Composition.** Study of the methods of exposition, the problems of argument, the use of evidence, and style; practice in writing with primary emphasis on exposition. This course fulfills the campus rhetoric requirement. 4 hours.
108. **Forms of Composition.** Study of the methods of exposition, the problems of argument, the use of evidence, and style; examination of verbal and nonverbal composition through use of a thematic approach. Specific topics to be announced. This course fulfills the campus rhetoric requirement. 4 hours.
133. **Principles of Composition.** Practice in exposition, with emphasis on organization, paragraphing, and sentence structure. For the student whose career will require competence in writing clear, precise prose as an adjunct to other professional activity. Credit is not given for Rhetoric 133 and Rhetoric 143. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
143. **Intermediate Expository Writing.** Practice in expository types, with emphasis on style and critical analysis. Recommended for rhetoric majors. Credit is not given for Rhetoric 143 and Rhetoric 133. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
144. **Narrative Writing.** Practice in description, narrative sketches, and story writing. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
145. **Poetry Writing.** Practice in the writing of poetry; experimentation with a number of fixed forms and free verse, but emphasis mainly on the student's freedom to develop a personal style. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
202. **Communications Workshop.** Independent writing projects and examination of literature as the cultural basis of the student's specialized fields. 3 hours.
205. **Advanced Narrative Writing, I.** Practice in the writing of fiction, with emphasis on the short story. Prerequisite: Rhetoric 144 or equivalent. 3 hours.
227. **Advanced Expository Writing.** Types of nonfiction prose, including the essay, criticism, biography, and historical writing. Prerequisite: Rhetoric 133 or 143, or consent of instructor. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Speech Communication 263, Theatre 280, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.
302. **Advanced Writing Topics.** Practice in various literary genres and in their combinations by the mature student who has some writing experience and a background of data

and impressions which he wishes to develop in writing of near- professional quality. Individual conferences at hours to be arranged. Prerequisite: Consent of instructor. 3 hours or 1 unit.

- 305. **Advanced Narrative Writing, II.** Continued practice in the writing of fiction, with emphasis on the longer story and novelette. Prerequisite: Rhetoric 205. 3 hours, or 1 unit.
- 306. **The Writing of Poetry.** Practice of the writing of poetry aided by intensive study of examples. Prerequisite: Rhetoric 145. 3 to 6 hours, or 1 or 2 units. May be repeated for a maximum of 6 hours or 2 units.
- 355. **Creative Writing Tutorial.** Personal direction in a writing project: fiction (novel or short stories), drama, poetry, criticism, nonfiction, narrative, etc. Frequency of conference to be determined by the type of project. Prerequisite: A preparatory course in advanced writing (Rhetoric 205, 227, 305, or 306; or Speech 263 or 363). 3 to 6 hours, or 1 to 2 units. May be repeated for a maximum of 6 hours or 2 units.

ENGLISH AS A SECOND LANGUAGE

Director of Division: Professor K. O. Astin

Division Office: 3070 Foreign Languages Building, Urbana

- 109. **English as a Second Language.** Intensive course in basic English structure for foreign students who are inadequately prepared for either Rhetoric 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test. No credit.
- 110. **English as a Second Language.** Study of the sounds and intonation patterns of American English and the relation of sound to spelling; designed to improve the student's ability to speak and understand English at normal conversational speed. May also be taken with Rhetoric 111 and 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test, or consent of instructor. No credit.
- 111. **English as a Second Language.** Continuation of Rhetoric 109. Rapid and intensive review of basic English structure and a study of more complicated sentence patterns with practice in simple oral and written composition. Designed for students inadequately prepared for Rhetoric 114. Prerequisite: Rhetoric 109 or recommendation from Illinois placement test, or consent of instructor. No credit.
- 114. **Composition for Undergraduate Foreign Students.** Oral and written composition and reading for students whose native language is not English. Prerequisite: Rhetoric 111, recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.
- 115. **Composition for Undergraduate Foreign Students.** Continuation of Rhetoric 114. Students who receive a grade of "C" or "D" in Rhetoric 115 must take the qualifying examination in English for foreign students; those who receive the grade of "fail" on this examination must take Rhetoric 201. Rhetoric 114 and 115 fulfill rhetoric requirements for foreign students. Prerequisite: Rhetoric 114 and/or recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.
- 199. **Undergraduate Open Seminar.** 0 to 9 hours.
- 302. **Descriptive English Grammar.** Same as English 302. 3 hours or 1 unit.
- 305. **Introduction to Applied Linguistics.** Same as Linguistics 305. Introduction to the applications of general linguistics theory to the specific fields of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign (and second) lan-

guages; practical assignment work. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.

350. **Sociolinguistics.** Same as Linguistics 350. A critical study of the sociologically oriented general linguistic theories with special reference to language varieties, language attitudes, language diversity, and language and political roles (language loyalty); emphasis on research methodology and techniques with concentration on South Asia. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
379. **American Language and Literature.** Noncredit course to develop facility in the English language through a study of American literature and culture. Open to any foreign student who has completed Rhetoric 109, 110, and 111, or who was not required to take these courses. No credit.
388. **Linguistics in Language Learning, I.** Same as Linguistics 388. Application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or $\frac{3}{4}$ unit.
389. **Linguistics in Language Learning, II.** Same as Linguistics 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the applications of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or $\frac{3}{4}$ unit.
400. **Verbal Communication in English as a Second Language for Graduate Foreign Students, I.** Language laboratory course concentrating on the typical writing problems that a graduate or research student encounters in an American university. Prerequisite: Graduate standing and Rhetoric 111, or consent of instructor. 0 to 4 hours. No graduate credit.
401. **Verbal Communication in English as a Second Language for Graduate Foreign Students, II.** Language laboratory course dealing with individual, immediate, and specialized speaking and writing problems, with particular attention to orienting graduate or research students to the techniques of the American university in thesis and other specialized writing, and in the oral presentation of such material. Prerequisite: Graduate standing and Rhetoric 400, or consent of instructor. 0 to 4 hours. No graduate credit.
419. **Contrastive Linguistics.** Same as Linguistics 419. Critical survey of contemporary linguistic models with special reference to their relevance in preparing contrastive analyses of languages; detailed discussion on contrastive analyses of English and selected non-Western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. $\frac{1}{2}$ or 1 unit.
463. **College Teaching of Foreign Languages.** Same as French, Russian, German, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations in Language Teaching.** Same as French, German, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: English as a Second Language 463 or consent of instructor. 1 unit.
487. **Seminar in the Teaching of English as a Second Language.** Discussion of and research into various topics of current interest to persons involved in teaching English as a second language; emphasis on new approaches to problems facing the field and the development of understanding methods; and study of materials leading to possible solutions. May be repeated as the topic changes. Prerequisite: English as a Second Language 388 or 302, or consent of instructor. $\frac{1}{2}$ to 1 unit.

491. **Research in Special Topics.** Independent study under guidance of a member of the graduate faculty. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated for a total of 2 units.

ENTOMOLOGY

(See Life Sciences)

ENVIRONMENTAL STUDIES

Director of Institute: Professor B. B. Ewing

Institute Office: 911 West High Street, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours. May be repeated.
299. **Individual Studies of Environmental Topics.** Individual studies of environmental problems and their solutions. Studies are accomplished under the immediate supervision of faculty of the Institute for Environmental Studies. Prerequisite: Consent of instructor. 0 to 4 hours.

FINANCE

Head of Department: Professor J. W. Leonard

Department Office: 340 Commerce Building (West), Urbana

150. **Money, Credit, and Banking.** Study of monetary and banking systems and the impact of monetary policy on employment, prices, economic growth, and international trade. Prerequisite: Economics 103 or 108. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
230. **Investment Principles.** Financial investment as promoter of economic productivity; securities: government, corporate, and mutual fund; securities markets: exchanges, brokers, and dealers; investment decisions in theory and practice; elements of security analysis and portfolio management; and the special case of mutual funds and their shares. Prerequisite: Economics 103 or 108. 3 hours.
235. **Investment Management.** Application of investment theory, analysis, and valuation methods to practical problems of investment management; selected cases and problems. Prerequisite: Finance 230 and 254. 3 hours.
252. **Banking Practice in the United States.** Study of the functions, operations, policies, organization, management, and supervision of banks. Prerequisite: Finance 150 and 254. 3 hours.
253. **Investment Banking.** Role of investment banking in the financial organization; investment banking houses; relation of investment banking to other financial institutions; regulation of investment banking and the security markets; and current problems and developments in investment banking. Prerequisite: Finance 150 and 254. 3 hours.
254. **Introduction to Business Financial Management.** Development and study of a decision framework for financial management; an introduction to the analysis of past and future needs; an analysis of the management of short-term assets; an introduction to a decision framework for capital investment management with an analysis of the cost and

sources of long-term capital; and integration of the concepts of financial management into a total systems approach to business decision making. Prerequisite: Accountancy 105 or 201; credit or concurrent registration in Economics 172. 3 hours.

255. **Financing Corporate Consolidation and Reorganization.** Financial aspects of industrial concentration; the combination movement; financing complex corporate enterprises; financial phases of reorganization; and the reorganization process. Prerequisite: Finance 254. 3 hours.
257. **Corporation Finance.** Study of the character of corporations; corporate securities; acquiring capital; internal financial control; expansion and intercorporate relations; and corporate capital readjustments. For noncommerce students only. Prerequisite: Economics 103 or 108. 3 hours. Credit is not given for both Finance 257 and 254.
258. **The Money Market and American Financial Institutions.** Study of the development and the practices of specialized financial institutions in the United States: commercial banking; central banking; savings banks; trust companies; investment banking; real estate finance; agricultural finance; and government financial institutions. Prerequisite: Economics 103 or 108. 3 hours.
260. **Economics of Insurance.** Survey course in the field of insurance to serve as a common introductory course to the fire, marine, casualty, surety, and life branches of the insurance business. Prerequisite: Economics 103 or 108. 3 hours.
262. **Life Insurance.** Study of the life insurance industry, companies, products, and markets. Prerequisite: Economics 103 or 108. 3 hours.
280. **Advanced Financial Management.** Integration of the capital investment, long-run financing working-capital decision processes; use of simulation, cases, and other techniques to study each decision process. Prerequisite: Finance 254. 3 hours.
294. **Senior Research.** Research and reading course for students concentrating in finance, insurance, urban land economics, or related areas who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better; (2) have attained Honors Day recognition in the junior year; or (3) have consent of instructor. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
295. **Senior Research.** Research and reading course for students concentrating in finance, insurance, urban land economics, or related areas who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better; (2) have attained Honors Day recognition in the junior year; or (3) have consent of instructor. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
340. **Consumer Finance.** Nature and importance of consumer finance; trends in consumer credit; instruments and institutions of consumer credit; economic effects of consumer finance; and consumer credit and public policy. Prerequisite: Economics 102 or 108; Finance 150 and 254; or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
357. **Financing Small Business.** Size and nature of small business; significance and limitations of small business; financial structure and problems; financial assistance to small business; and future prospects of small business. Prerequisite: Finance 254 or 257. 3 hours, or $\frac{1}{2}$ to 1 unit.
360. **Employee Benefit Plans.** Same as Labor and Industrial Relations 360. Analysis of the economic and financial issues involved in designing and administering employee benefit plans; major emphasis on group life, disability income, and medical care plans and to "qualified" pensions and profit-sharing plans for regular employees; and some attention to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Business Administration 351, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
363. **Seminar in Life and Health Insurance.** Seminar devoted to discussions of current financial, legal, and social problems involving life and health insurance; discussion of legal and financial problems involving life and health insurance product development,

life and health insurance in estate planning, government regulation of the life insurance industry, and the economic aspects of the industry. 3 hours, or $\frac{1}{2}$ to 1 unit.

364. **Fundamentals of Real Estate and Urban Economics.** Determinants of growth and development; survey of problems affecting land resource allocation: transportation, poverty, employment, public finance, and housing; introduction to systems analysis, cost-benefit, and cost-effectiveness studies, real estate market forecasting, appraising, economic base analysis, financing, construction, and land-use controls. Prerequisite: Six hours of economics and a course in political science or sociology, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
365. **Urban Land Investment Analysis.** Provides an analysis on framework for urban real estate investment decisions by individuals and institutions; exposition of rate-of-return analysis illustrated by actual investment situations. The determinants of real estate investment policy for borrowers and lenders requires consideration of mortgage markets, government policies, risk controls, and analysis of different types of real estate investments. Prerequisite: Finance 364 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
366. **Valuation Theory and Methods.** Concentration on land value theory and methods; primary concern on the selection of a valuation theory which produces an ethical valuation as needed by buyers, sellers, lenders, the government, insurers, etc.; examination of the role of the appraiser as evaluator, expert witness, and counselor; and use of case method to demonstrate principles and practices. Prerequisite: Finance 364 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
367. **The Urban Public Economy.** Same as Economics 361. Economic analysis of public policy with respect to urban problems; a full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; and the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land-use controls, pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Risks and Risk Management.** Analysis of the financial problems in the risks of property damage or bodily injury (in business situations), and evaluation of the alternative methods for dealing with such problems. Prerequisite: One of the following: Accountancy 105 or 201, or Finance 254 or 257; Economics 103 or 108. 3 hours, or $\frac{1}{2}$ to 1 unit.
371. **Seminar in Property and Liability Insurance.** Seminar devoted to discussions of current financial, legal, and social problems involving property-liability insurance; analysis of legal problems involving insurance coverages, financial aspects, and governmental regulation of the property-liability insurance enterprise, and economic aspects of the insurance industry. 3 hours, or $\frac{1}{2}$ to 1 unit.
420. **Central Banking Policy.** Examination of modern theories of monetary management, gold standard theories, central banking, fiscal policy, debt management, and their relation to monetary policy. 1 unit.
425. **The Money Market and Financial Stabilization.** Study of interest rate determination; the structure and operations of the money and capital markets; and the objectives and implementation of monetary, fiscal, and debt management policies. Prerequisite: Finance 150. 1 unit.
427. **Research Seminar in Banking.** Research reported and explored in areas of commercial bank models and behavior, bank structure and regulation, and central bank control; current topics, specialized areas in banking, and research procedures are discussed by instructor, students, and guest lecturers. Prerequisite: One semester of graduate economic theory; Economics 470. 1 unit.
452. **Analysis of Financial Systems.** Same as Business Administration 552. Integration of the investment, long-run financing and short-run investment-financing decision processes; the decision process studied by simulation models and/or other techniques to introduce the dimensions of uncertainty, dynamism, and multivariables. Prerequisite: Finance 243 or Business Administration 551, or equivalent; Economics 470, Business Administration 572, or concurrent registration in either course. 1 unit.

453. **Advanced Analysis and Theory.** Same as Business Administration 553. Special emphasis on research and model building of the financial decision system; analysis of financial decision systems examined by using various techniques, e.g., Markov process, decision theory, statistical models, linear and/or dynamic programming, risk analysis, and forecasting models. Prerequisite: Finance 452 or Business Administration 552, or equivalent. 1 unit.
454. **Corporation Finance.** Nature of corporation finance and its relation to economics, accounting, and law; development of business corporation; concepts of capital, capitalization, and capital stock; nature of equities in corporation; financial analysis and interpretation; nature and development of financial plans; corporate securities and their adaptation to financial plan; initial and promotional financing; current capital financing; income administration; and refinancing. Prerequisite: Finance 254. 1 unit.
455. **Seminar in Finance.** Philosophy of research; critical evaluation of selected research; emphasis on empirical studies; evaluation of analytical methods employed; relation of research questions to research methods; and development of thesis research topics. Prerequisite: Finance 453 or Business Administration 553, or Finance 458 or Business Administration 558. 1 unit.
456. **Investment.** Study of the financial process by which savings are transformed into capital; theories of investment value and of portfolio composition; critique of individual and institutional portfolio policies; and survey of investment literature. 1 unit.
457. **Security Analysis and Investment Management.** Same as Business Administration 557. Application of decision theory and quantitative methods to problems of individual security valuation and selection, portfolio composition, and investment management. Prerequisite: Finance 254 or equivalent, or Business Administration 551 or equivalent. 1 unit.
458. **Portfolio Theory.** Same as Business Administration 558. Theoretical and research-oriented course related to the problems of efficient allocations of resources in security portfolios of large financial institutions; integration of interdisciplinary problems such as capital market price behavior and stock price behavior with portfolio analysis models. Prerequisite: Finance 457 or Business Administration 557, or equivalent.
460. **Theory of Insurance.** Study of the nature and cost of risk in our economic society, and of the methods of handling it. 1 unit.
468. **Studies in Urban Economics: Environment and Land Use.** Economic forces and policies affecting location, growth, and economic base of the city; consideration of problems affecting urban resource allocation and location: housing, transportation, ecology, segregation, public finance, and strategies in community development; and consideration of theories and methods of analysis of effective urban resource allocation and valuation. Graduate students should consult with the instructor as to whether Finance 364 or this course is preferable. 1 unit.
469. **Problems and Policies in Urban Economics.** Urban development and the national economy; interaction of business institutions and public agencies in performance of urban functions; determinants of land-use patterns; economic aspects of property rights and land-use controls; and unmet needs. Students undertake intensive analysis problem selected for individual study; cooperation with urban planning, architecture, landscape architecture, and other departments. Prerequisite: Finance 364 or 468, or consent of instructor. 1 unit.
470. **Risk Management and Control.** Same as Business Administration 555. Analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses; techniques for risk and loss control; models for risk management decision making; and procedures for administering risk management policy relating to non-speculative (insurable) risk. 1 unit. Prerequisite: Business Administration 552 and 560, or equivalent, or consent of instructor. 1 unit.
490. **Individual Study and Research.** Directed reading and research. $\frac{1}{2}$ to 1 unit.
499. **Thesis Research.** Required for those writing master's and doctoral theses in finance. 0 to 4 units.

FINE AND APPLIED ARTS

Program Administrator: Professor J. H. McKenzie

Program Office: 110 Architecture Building, Urbana

- 100. **Language and Design, I.** Comprehension of systems, analysis, methods of verbal and visual aspects of communication, and design, emphasizing practical application to a professional career. Primarily for freshman and sophomore members of the Educational Opportunities Program in architecture, art, urban planning, and landscape architecture. 0 to 6 hours.
- 101. **Language and Design, II.** Continuation of Fine and Applied Arts 100. Prerequisite: Fine and Applied Arts 100. 0 to 6 hours.
- 199. **Undergraduate Open Seminar.** 0 to 9 hours.
- 299. **FAA Study Abroad.** Provides campus credit for foreign study and/or travel. A detailed proposal for study abroad must be submitted for approval by the appropriate committee of the department in which the student is studying and the college dean's office prior to such study abroad. Final determination of credit and its application toward the degree is made after a review of the student's work abroad by the above committee and college office. Prerequisite: Junior standing in the department; approval of the student's proposal by the departmental committee and the college office. 0 to 12 hours (summer session, 0 to 6 hours).

FOOD SCIENCE

Head of Department: Professor A. J. Siedler

Department Office: 567 Bevier Hall, Urbana

- 101. **Food in Modern Society.** Emphasis on the importance of food in providing adequate nutrients for modern society; introduction to processing and preservation of foods as well as the historical, geographical, chemical, and microbiological ramifications which exist in the food industry. 3 hours.
- 202. **Sensory Evaluation of Foods.** The physiology, psychology, and chemistry of flavor and flavor perception; tactual, visual, and auditory components affecting food acceptability; principles and application of preference and discrimination testing; and interpretation of panel evaluation data. 3 hours.
- 206. **Inspection Trip.** Inspection of typical examples of food preservation and manufacturing plants. A three- to four-day trip required of all seniors; estimated cost, \$35.00. Prerequisite: Junior standing in food science or consent of department. No credit.
- 213. **Food Analysis, I.** Principles and application of the chemical methods used to determine the major and minor constituents of foods; physical measurements applied to foods; and special considerations applicable to the analysis of certain foods. Prerequisite: Chemistry 102. 3 hours.
- 214. **Survey of Food Chemistry.** Chemical composition of foods and the chemistry of the processing of meats, vegetables, fruits, milk, and cereals. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 102. 3 hours.
- 260. **Raw Materials for Processing.** Lectures, reference readings, and laboratory experiments concerning the problems involved with procurement, harvesting, handling, and storage of fruits, vegetables, cereal grains, dairy products, and meat for the food-processing industry. Field trips to specialized operations. Prerequisite: One course in biological science and Food Science 101, or consent of instructor. 4 hours.

- 300. Special Problems.** Supervised research on special problems in food science and dairy technology. Prerequisite: Written consent of instructor must be obtained prior to enrollment. Not open to undergraduates who are on probation. The honors section is open to Janes Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{3}{4}$ to 1 $\frac{1}{2}$ units in one semester. May be repeated to a maximum of 2 units.
- 301. Food Processing.** Principles and application involved in canning, freezing, dehydrating, flour milling, luncheon meats, freeze drying, and plastic films. Field trips to food processing and manufacturing operations. Prerequisite: Food Science 202, 213, or 260, or consent of instructor. 5 hours or 1 $\frac{1}{4}$ units.
- 308. Food Plant Management.** Problems in the organization, financing, labor management, and operation of food plants. Prerequisite: Senior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 310. Dairy Product Processing.** Theory and practice in procurement of milk, separation and creaming phenomena, homogenization, and heat treatment; concentrating, drying, and freezing as applied to fluid milk products, cultured milk products, concentrated and dried milk products, ice cream, butter, and cheese. Prerequisite: Food Science 213 and 260, or consent of instructor. 5 hours or 1 $\frac{1}{4}$ units.
- 313. Food Analysis, II.** Laboratory exercises, demonstrations, and assigned readings dealing with the application of analytical chemical and instrumental techniques to the analysis of food constituents. Prerequisite: Food Science 213 or equivalent, such as quantitative analysis. 4 hours or 1 unit.
- 314. Food Chemistry, I.** Major chemical components of foods, lipids, carbohydrates, and proteins, and the chemical changes that occur during processing and storage. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 131 and 134. 3 hours or $\frac{3}{4}$ unit.
- 315. Food Chemistry, II.** Minor chemical components of food: vitamins, pigments, salts, trace elements, and enzymes, and the changes that occur in them during processing and storage; the physical and colloidal properties of foods; food additives and contaminants; and metabolism of foods. Prerequisite: Food Science 314. 3 hours or $\frac{3}{4}$ unit.
- 324. Problems of Nutrition.** Same as Home Economics 324. Discussions and investigations. Prerequisite: Biochemistry 350 and 355, or Biochemistry 354 and 356; Home Economics 220; senior standing. 3 to 5 hours, or $\frac{1}{2}$ to 1 unit.
- 332. Principles of Sanitation in the Processing and Handling of Foods.** Study of the principles of sanitation with appropriate emphasis on practical considerations as they apply to various food-processing industries; control of insects, rodents, and micro-organisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods; and government and public health regulations. Field trips to local food-processing plants. Prerequisite: Microbiology 100 and 101; Chemistry 102. 2 hours or $\frac{1}{2}$ unit.
- 340. Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
- 363. Introduction to Process Engineering.** Fundamentals of heat transfer, fluid flow, evaporation, drying, and other unit operations in the process industries. Prerequisite: Calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 373. Advanced Food Microbiology.** Fundamentals of those food and industrial processes which are dependent on fermentation or other microbial activities. Prerequisite: Chemistry 131, Microbiology 311, and a course in calculus. 3 hours or $\frac{3}{4}$ unit.
- 391. The Chemistry of Lipids in Foods.** Detailed survey of the chemical and physical prop-

- erties of lipids. Prerequisite: Biochemistry 350 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
401. **Physical Chemical and Colloidal Phenomena of Food Products.** Study of physical, chemical, and colloidal phenomena involved in the processing of food products including such topics as food emulsion, foams, gelation, coagulation, rheology, and membrane phenomena in foods. Prerequisite: Chemistry 340 and 341. 1 unit.
406. **State and Metabolism of Lipids.** Advanced study of the state of lipids in animal tissues and in biological fluids, and of the metabolism of lipids in relation to dietary fats and other food constituents. Prerequisite: Biochemistry 350 or consent of instructor. 1 unit.
410. **Current Topics in Nutritional Research.** Same as Nutritional Sciences 410 and Dairy Science 410. A discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350 and an upper-division course in nutrition. $\frac{3}{4}$ unit.
411. **Chemistry of Nutritional Processes.** Same as Nutritional Sciences 411 and Dairy Science 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350 and an upper-division course in nutrition. 1 unit.
421. **Seminar.** Discussions on specialized topics and current literature relating to food technology. Required of all graduate students in food science. $\frac{1}{4}$ unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Food Science 340 or equivalent. $\frac{3}{4}$ unit.
481. **Advanced Special Problems in Food Science.** Supervised individual study on advanced special problems in food science. Prerequisite: Written consent of instructor must be obtained prior to enrollment. $\frac{1}{2}$ to 2 units (summer session: $\frac{1}{2}$ to 1 unit).
499. **Thesis Research.** 0 to 4 units.

FORESTRY

Acting Head of Department: Professor I. I. Holland
Department Office: 219 Mumford Hall, Urbana

100. **Farm Forestry.** Study of those phases of forestry which are applicable on Illinois farms: identification of the principal trees; identification, properties, and uses of common woods; harvesting and marketing of principal products of farm woodlands; preservative treatment of farm timbers; measurement of logs, trees, and stands; determination of growth rate and value; life history of the forest and silvicultural handling of woodlands, including the care of growing forests and the selection of trees for harvest; natural reproduction of forests and tree planting for wood products, erosion control, and windbreaks; protection of woodlands; place of farm woodlands in the agricultural economy; public aids to woodland owners; and educational programs for youth and adults. Especially for students in general agriculture curricula, including agricultural extension and soil conservation majors, and in the agricultural education curriculum. Prerequisite: Enrollment in College of Agriculture or College of Education, or consent of instructor. 3 hours.
101. **General Forestry.** The forest as a renewable natural resource; the aims and scope of forestry; economic and social importance of forests to the nation; the principal forest regions and species; forests for timber supply, for water conservation, for recreation, and for wildlife; the principles of forest management and protection; the development

of public and private forestry in the United States; and forestry as a profession. Prerequisite: Enrollment in a forestry curriculum or sophomore standing. 3 hours.

199. **Undergraduate Open Seminar.** 1 to 5 hours.

200. **Special Problems.** Supervised research on special problems in forestry. Prerequisite: A minimum grade-point average of 3.75; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 3 hours.

211. **Forest Ecology (Summer Field Studies).** Field study of the structure and dynamics of forest ecosystems and the effects of management on those systems. Prerequisite: Botany 100 and Zoology 104, or one year of biology; registration in summer field studies. 3 hours.

213. **Silviculture.** The art and science of controlling forest establishment, composition, and growth that will best fulfill the objectives of the owner. Prerequisite: Forestry 211. 3 hours.

220. **Dendrology.** Taxonomy, geographical distribution, economic importance, and elementary silvics of the important forest trees in the United States and Canada. Prerequisite: Botany 100. 4 hours.

221. **Introduction to Forest Measurements (Summer Field Studies).** Introductory course designed to acquaint the student with the methods and problems of measuring forest areas, trees, and forest products, with emphasis on field work; elementary work on tree measurement and volume; board measure; scaling; and the location, mapping, and inventory of forest properties. Prerequisite: Registration in summer field studies. 3 hours.

222. **Advanced Forest Measurements.** Continuation of Forestry 221. Introduction to statistics and statistical methods in forest mensuration; principles and methods of volume; and growth estimation and forest inventory. Prerequisite: Forestry 221; Agronomy 340. 3 hours.

231. **Wood Utilization (Summer Field Studies).** Field and class exercises in logging, milling, equipment maintenance, and use; the industrial aspects of wood use. Prerequisite: Registration in summer field studies. 2 hours.

232. **Wood Utilization.** Principles, methods, and costs of harvesting, grading, and transporting forest products; conversion of logs, bolts, and cordwood; the physical-mechanical properties and defects of wood; and specifications and uses of lumber, veneer, plywood, pulp, paper, and chemical derivatives. Prerequisite: Forestry 231. 3 hours.

236. **Physical Properties of Wood and Wood-Base Materials.** Physical properties of wood materials, emphasizing the influence of anatomy, density, and moisture content; wood-liquid relations; thermal, electrical, and acoustical properties; and study of the theory and practice of wood seasoning for determining dimensional stability. Prerequisite: One year of college physics and one year of college chemistry, or consent of instructor. 3 hours.

242. **Forest Resources Management.** Concepts, techniques, and management tools applied to forest properties managed for continuous production of timber and other forest products; determination of optimum rotation and growing stock; and appraisals, taxation, and management planning. Prerequisite: Forestry 222; senior standing. 4 hours.

253. **Forest Economics.** Concepts of economic supply of, and demand for, the major wood products; trends in wood products consumption and prices, and the major marketing problems; and prospects for future development of U.S. wood products industries and trade. Prerequisite: Economics 108. 3 hours.

256. **Surveying Agricultural and Forest Lands.** Same as Agricultural Engineering 256. Basic surveying procedures as applied to practices in soil and water conservation engineering and forest management and engineering. Prerequisite: Mathematics 114. 2 hours.

260. **Forest Land Policy and Administration.** Forest land policies and their administration with emphasis on the relations among resources, politics, and people; current major

problems in forest land policy administration and progress toward their solution. Prerequisite: Economics 108 or consent of instructor. 3 hours.

271. **Wood Anatomy and Identification.** Study of the macroscopic, microscopic, and ultra-microscopic structure of wood and the identification of many important commercial woods by means of anatomical characteristics; fundamental physical and chemical properties of wood. Prerequisite: Enrollment in forest science or wood science curricula, or consent of instructor. 3 hours.
273. **Adhesives and Laminates.** Physical and chemical properties of the principal adhesives used to bond wood and other materials; principles of adhesion; and manufacture, properties, and uses of plywood, laminated wood, and other products. Prerequisite: Enrollment in the wood science curriculum or consent of instructor. 3 hours.
274. **Wood Preservation.** Theory and application of wood preservation; agencies causing deterioration of wood and their control; and fire retardants, treating chemicals, and processes. 3 hours.
275. **Seminar in Wood Science.** Individual problems in the field of wood technology and utilization chosen by the student. Each problem involves library studies, verbal reporting, and group discussion. Prerequisite: Junior standing in the wood technology and utilization curriculum. 2 hours.
316. **Environment and Tree Growth.** Growth and development of forest trees as related to environmental factors, with special emphasis on microsite changes induced by silvicultural practices. Completion of a special project required for graduate credit. Prerequisite: Forestry 211 or consent of instructor. 4 hours or 1 unit.
319. **Environment and Plant Ecosystems.** Same as Agronomy 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes; discussion of physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels. Prerequisite: One course in biology; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
330. **Forest Land Use.** Use of forest land for purposes other than timber production with emphasis on watershed management, wildlife habitat, wildland recreation, and the integration of uses for multiple-use management. Completion of a special project required for graduate credit. Prerequisite: One year each of chemistry, biology, and social science, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and to the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
362. **Forest Entomology.** Study of the characteristics, life histories, and forest relationships and controls of the economically important forest insects of the United States. Prerequisite: One year of biological science and one year of chemistry. 3 hours or $\frac{3}{4}$ unit.
372. **Mechanical Properties of Wood and Wood-Base Materials.** Static mechanics, strength properties, and structural designs of wood, plywood, particleboard, and hardboard, emphasizing the standard methods of testing wood and fibrous material, wood beam and column designing, and other factors concerning the strength of wood materials, particularly the derivation of allowable stresses. Prerequisite: Forestry 236, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Seminar.** Discussions on specialized topics and current literature in forestry. Required of all graduate students in forestry. $\frac{1}{4}$ unit. May be repeated for a total of $\frac{1}{2}$ unit.
401. **Special Problems.** Individual studies or investigations in selected branches of forestry. $\frac{1}{2}$ to 1 unit. Not more than 2 units may be offered toward an M.S. degree.
414. **Discussions in Forest Ecology and Physiology.** Individual and group discussions of developments and techniques in forest ecology and physiology based on classic and cur-

rent literature. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated for a maximum of 1 unit.

440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of the principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Forestry 340 or equivalent. $\frac{3}{4}$ unit.
460. **Discussions in Forest Policy and Administration.** Individual and group discussions of the major relevant problems in the field of forest resources policy and administration (both public and private) based on current literature. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated for a maximum of 1 unit.
499. **Thesis Research.** Research may be conducted in various phases of forestry; subject must be approved by departmental committee. 1 to 3 units.

FRENCH

Head of Department: Professor R. J. Nelson

Department Office: 2090 Foreign Languages Building, Urbana

100. **Preparatory French.** Introduction to the nature of language and its relation to the study of French, the values of foreign language study, and the methods of foreign language study, as well as an introduction to French language and culture. 3 hours.
101. **Elementary Course, I.** Grammar, pronunciation, reading of modern authors, composition, and conversation. For students who have had no work in French. All students are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **Elementary Course, II.** Continuation of French 101. All students are required to register for one hour of work weekly in the language laboratory. Prerequisite: French 101 or one year of high school French. 4 hours.
103. **Modern French.** Reading of modern authors; conversation and pronunciation; and syntax and some composition. Students planning to major or minor in French should take French 133 in lieu of French 103. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
104. **Modern French Literature and Civilization.** Continuation of French 103. Reading of modern authors and an introduction to French civilization; some syntax and composition; and conversational practice. Completion satisfies graduation requirements in the College of Liberal Arts and Sciences. Students planning to take advanced French courses are to take French 134 in lieu of French 104. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
105. **Intensive Elementary French.** Equivalent to French 101 and 102. Oral comprehension, speaking, reading, and writing skills approached by the audiolingual method; some reading of literary texts. For students who have had no previous French and who want to learn at a rapid rate. All students are required to register for two hours of work weekly in the language laboratory. 8 hours.
106. **Intensive Elementary and Intermediate French.** Combines French 102 and 103 for students having attained 101 proficiency and who wish to advance more rapidly. Prerequisite: French 101 or equivalent, or a placement score showing high school achievement equivalent to French 101. 8 hours.
107. **Intensive Intermediate French.** Combines French 103 and 104 for students having attained 102 proficiency and who wish to advance more rapidly. Prerequisite: French 102 or 105, or equivalent. 8 hours.

113. **Conversational Practice.** Oral practice for the development of elementary conversational skill and the improvement of pronunciation. Designed as a supplement to French 103 or 104, and open only to students concurrently enrolled in either French 103 or 104. Prerequisite: French 102 or two years of high school French. 1 hour.
114. **Conversational French.** Practice in spoken French. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or 123, or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
123. **Readings in French Literature.** Readings in French literature (texts in French with discussion in English); some grammar essential to development of reading skill; and additional readings in English of authors treated assigned according to demonstrated interest. Serves as prerequisite to French 124; students planning to take advanced French courses should enroll in French 133. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
124. **Readings in French Literature.** Additional readings in English of authors treated will be assigned according to demonstrated interest. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103; French 123; placement by virtue of high school units (usually three years). 4 hours.
133. **Accelerated Modern French.** Same as French 103, but accelerated for those interested in pursuing French in advanced courses. Prerequisite: French 102 or two semesters of college French, or a placement score showing high school achievement equivalent to French 102. Normally for students with a B average in French or with consent of instructor. 4 hours.
134. **Accelerated Modern French Literature and Civilization.** Reading of major French writers from several centuries, and introduction to French civilization, syntax and composition, and conversational practice. An accelerated course for those intending to take advanced courses in French. Prerequisite: French 133, or French 103 with department approval, or three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
144. **France and the French in the Twentieth Century.** Contemporary French life and institutions reflected in modern writing; some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103, three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
154. **Contrastive Studies of French and American Culture.** Provocative commentaries on aspects of American life and institutions by contemporary French writers and intellectuals; some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
164. **French Readings in the General Sciences.** Designed for those interested in a reading background in general scientific works. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite to advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or

equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.

174. **Readings in French Newspapers and Magazines.** Study of current events and contemporary French life from the reading of newspapers and magazines specially ordered from France; requires fee of \$5.00 to cover subscription cost. May be substituted for French 104 to satisfy graduation requirements of the College of Liberal Arts and Sciences; does not serve as a prerequisite to advanced courses in French without departmental approval which usually requires examination at the 104 level. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to French Literature.** Prerequisite: French 104 or 107, or four years of high school French, or equivalent. 3 hours.
202. **Introduction to French Literature.** Continuation of French 201. Prerequisite: French 104 or 107, or four years of high school French, or equivalent. 3 hours.
203. **Selections in Contemporary French Literature.** Masterpieces of contemporary authors. Prerequisite: French 201 and 202, or equivalent. 2 hours.
207. **Studies in French Fiction.** Study of different types of narrative in French literature, with an emphasis on shorter forms. Prerequisite: French 201 or equivalent. 3 hours.
208. **Studies in French Theatre.** Critical examination of ideas and practices in the theatre and their illustration in a number of French plays. Prerequisite: French 201 and 202, or equivalent. 3 hours.
211. **Oral French, I.** Training for the development of oral facility; exercises for the improvement of pronunciation and diction; and practice in the language laboratory required. Prerequisite: French 104 or 107, or 103 and 113, or four years of high school French. 3 hours.
212. **Oral French, II.** Continuation of French 211; practice in the language laboratory required. Prerequisite: French 211. 3 hours.
215. **French Composition.** Training in French syntax, translation from English into French, written French, and free composition. Prerequisite: Four years of high school French or equivalent, or French 134 or, with departmental approval, French 104 or 107. 3 hours.
217. **Advanced Oral French.** An intensive course stressing comprehension, pronunciation, diction, and fluency; work includes conversation, oral reports, and group discussions. Required of French teacher-education majors. Prerequisite: French 212. 4 hours.
218. **Conversation dirigée.** Directed conversation stressing fluency and accuracy in French through conversations, reports, and discussions specifically centered around contemporary French life and culture. May not be used to satisfy major requirements. Prerequisite: French 217 or equivalent. 2 hours.
220. **Sixteenth-Century Literature.** General survey of the literature of the French Renaissance. Prerequisite: French 201 or equivalent. 3 hours.
223. **French Literature of the Seventeenth Century, I.** Major French writers of the preclassical period. Prerequisite: French 201 or equivalent. 3 hours.
224. **French Literature of the Seventeenth Century, II.** Major French writers of the classical period. Prerequisite: French 201 or equivalent. 3 hours.
227. **French Literature of the Eighteenth Century, I.** Montesquieu, Voltaire, and their contemporaries. Prerequisite: French 201 or equivalent. 3 hours.
228. **French Literature of the Eighteenth Century, II.** Diderot, Rousseau, and their contemporaries. Prerequisite: French 201 or equivalent. 3 hours.
230. **French Literature of the Nineteenth Century, I: 1800-1850.** Major prerealist and romantic writers. Prerequisite: French 202 or equivalent, or consent of instructor. 3 hours.
231. **French Literature of the Nineteenth Century, II: 1850-1900.** The evolution of romanticism and realism into the naturalist and symbolist movements. Prerequisite: French 202 or equivalent, or consent of instructor. 3 hours.

233. **French Literature of the Contemporary Period, I.** Modern poetry from Baudelaire to Valéry; prose writers from 1900 to 1940. Prerequisite: French 201 or equivalent. 3 hours.
234. **French Literature of the Contemporary Period, II.** Continuation of French 233. Prerequisite: French 201 or equivalent. 3 hours.
255. **Introduction to French Literature in Translation, I.** Same as Humanities 255. Study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures in English; not open to students majoring in French. 4 hours.
256. **Introduction to French Literature in Translation, II.** Same as Humanities 256. Study of selected major works of French literature from the romantic period to the present. Texts and lectures in English; not open to students majoring in French. 4 hours.
261. **French Abroad, I.** Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 201 and two of the following: French 211, 212, 213, 214, or 215; 3.75 overall average; 4.0 average in French courses. 0 to 15 hours.
262. **French Abroad, II.** Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 261. 0 to 15 hours.
270. **Parateaching in French.** Parateaching prior to the practicum in local schools under the direct supervision of University of Illinois French faculty and the teaching staff of participating public schools. Prerequisite: French 212 and 214, or equivalent; permission of French teaching education adviser. 2 hours. May be repeated for credit.
275. **The Teaching of French.** Methodology for the teaching of French designed especially for a major in a field other than a foreign language. Prerequisite: French 212; enrollment in a teacher education curriculum with a minor in French. 2 hours.
280. **Teachers Course.** Survey of resources, classroom materials, standard practices, and problems in the teaching of French with practical application to actual classroom situations. Required for teacher training majors in French. This course does not meet during the period teacher-training majors are off campus. Prerequisite: French 201 and 202, and 211 and 212, and 215, or equivalent; concurrent registration in Secondary Education 241. 4 hours.
291. **Thesis and Honors, I.** For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours.
292. **Thesis and Honors, II.** For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours.
295. **Major Tutorial.** A tutorial taken by the student in the course of three of his last four semesters of undergraduate study. Students read the works on a departmental reading list with the guidance of a tutor, repeating enrollment for a total of 3 hours credit, normally at the rate of 1 hour per semester. Prerequisite: French 201, 211, and 215, or equivalent; a declared major in French; junior standing. 1 to 2 hours.
299. **French Senior Seminar.** Studies in authors, genres, themes, and movements in French literature; conducted entirely in French. Prerequisite: French 261 and 262, or equivalent; consent of head of department. 3 hours. May be repeated for credit.
311. **Diction.** Training in the improvement of French pronunciation, with special attention to the problems of teachers. It is recommended that French 311 and 313 be taken concurrently. Prerequisite: French 211 or equivalent. 2 hours or $\frac{1}{2}$ unit.
313. **Phonetics.** Systematic study of the sounds and sound patterns of French. It is recommended that French 313 and 311 be taken concurrently. Prerequisite: French 212 or equivalent. 3 hours or $\frac{3}{4}$ unit.
314. **Syntax.** Advanced theoretical and practical study of present-day French, with some consideration of stylistics. Prerequisite: French 215 or equivalent. 3 hours or $\frac{3}{4}$ unit.
315. **Stylistics.** Linguistic analysis of a variety of French prose styles to illustrate the range of expressions for the same or similar ideas; translation into French of fairly difficult English prose; and occasional directed composition. Prerequisite: French 314. 3 hours or $\frac{3}{4}$ unit.

316. **Structure of the French Language.** Same as Linguistics 316. General survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax; emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or $\frac{3}{4}$ unit.
335. **French Civilization, I.** Survey of French life and French institutions, intended as a background for literary studies and as a preparation for the teaching of French; given in French. Prerequisite: French 201, 211, and 213, or equivalent. 3 hours or $\frac{3}{4}$ unit.
336. **French Civilization, II.** Continuation of French 335. Prerequisite: French 201, 211, or 215, or equivalent. 3 hours or $\frac{3}{4}$ unit.
341. **Lectures de Proust, I: A la recherche du temps perdu.** Readings and textual explication in Marcel Proust's novel; covers approximately the first half of Proust's novel. Prerequisite: French 201, 211, and 215, or equivalent. 3 hours, or $\frac{3}{4}$ to 1 unit.
342. **Lectures de Proust, II: A la recherche du temps perdu.** Readings and textual explication in Marcel Proust's novel; covers the second half of Proust's novel. Prerequisite: French 341 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
343. **Studies in French Literature.** Topics to be announced. Prerequisite: Junior standing. 3 hours, or $\frac{3}{4}$ to 1 unit.
355. **France Today, I.** Social structures of France today and their manifestation in daily life and culture; study of the workings of various institutions and systems (political judicial, economic, educational, etc.) for an understanding of current problems, providing background for closer study, in the second semester, of the forces affecting daily life. 3 hours, or $\frac{3}{4}$ to 1 unit.
356. **France Today, II.** Study of the conditions of daily life in France today, its organization, the major forces and issues affecting it; topics include class structure, youth culture, urban and minority problems, the press, media, and popular culture and the arts. 3 hours, or $\frac{3}{4}$ to 1 unit.
362. **Introduction to Romance Linguistics.** Same as Italian, Linguistics, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{1}{2}$ unit.
382. **Language Laboratory Techniques.** Same as German, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level or equivalent. 2 hours or $\frac{1}{2}$ unit.
400. **Beginning French for Graduate Students.** Basic grammar, vocabulary, and reading practice; designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. 4 hours. No graduate credit.
401. **Reading French for Graduate Students.** Grammar, vocabulary, and general and special reading; designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. Prerequisite: French 400, or French 101 and 102, or equivalent. 4 hours. No graduate credit.
403. **The Study of Culture: Fine Arts, History, and Literature, I.** Master works studied with a special view to their presentation in foreign language programs in secondary schools and in junior colleges; designed for students in the program for the Master of Arts in the Teaching of French. Prerequisite: Admission to the program for the Master of Arts in the Teaching of French. 1 unit.
404. **The Study of Culture: Fine Arts, History, and Literature, II.** Master works studied with a special view to their presentation in foreign language programs in secondary schools and in junior colleges; designed for students in the program for the Master of Arts in the Teaching of French. Prerequisite: French 403 or consent of instructor. 1 unit.
405. **Techniques in Teaching College and Secondary French.** Examination and discussion of classroom procedures and language laboratory techniques in teaching French at the college and secondary level, associated with demonstration class and supervision of

teaching practice. Required of new teaching assistants in the Department of French. No credit.

430. **Introduction to Research and Textual Criticism.** Proseminar in literary studies: research and methods; approaches to the literary text. Required of all M.A. and Ph.D. candidates. 1 unit.
433. **Studies in Sixteenth-Century French Literature, I.** Major writers of the sixteenth century studied with reference to the most important intellectual and religious preoccupations of their century. 1 unit.
434. **Studies in Sixteenth-Century French Literature, II.** Themes and techniques of major poets and poetic schools of the sixteenth century. 1 unit.
435. **Studies in Seventeenth-Century French Literature, I.** 1 unit.
436. **Studies in Seventeenth-Century French Literature, II.** 1 unit.
437. **Studies in Eighteenth-Century French Literature, I.** 1 unit.
438. **Studies in Eighteenth-Century French Literature, II.** 1 unit.
439. **Studies in Nineteenth-Century French Literature, I.** Studies in nineteenth-century literature to 1850. 1 unit.
440. **Studies in Nineteenth-Century French Literature, II.** Studies in nineteenth-century literature after 1850. 1 unit.
441. **Studies in Twentieth-Century French Literature, I.** Twentieth-century poets and novelists. 1 unit.
442. **Studies in Twentieth-Century French Literature, II.** Twentieth-Century poets and novelists. 1 unit.
443. **French Studies.** A flexible course limited only by the concentration of its material in French; may be activated by student request or faculty proposal. 1 unit.
448. **Studies in French Descriptive Linguistics.** Selected specialized topics in the morphology, derivation, and syntax of contemporary standard French; topics vary each semester, e.g., verb morphology, noun derivation, interrogative systems, and nominal phrases. Prerequisite: French 316. 1 unit.
449. **Introduction to Old French Language and Literature.** Training in reading Old French (twelfth and thirteenth centuries) and outline of Old French grammar; reading of characteristic works; and outlines of literary history. 1 unit.
450. **Historical French Grammar.** Study of the development of the French language, principally Old French, from Latin. Prerequisite: French 449; an elementary knowledge of Latin. 1 unit.
451. **Studies in Medieval French Literature.** Close study of one or more topics in Old French literature. Prerequisite: Consent of instructor. 1 unit.
452. **Studies in French and Comparative Cinema.** Same as Comparative Literature 472. Historical, aesthetic, social, and technical studies of the French cinema; its development and relation to world cinema and to literature. 1 unit.
455. **History of French Literary Criticism.** Literary theory and practice of criticism as developed in France from the sixteenth to the twentieth centuries; analysis and discussion of preoccupations, critical methods, and approaches to literature of representative critics, with emphasis upon emergence of philosophies of criticism. 1 unit.
462. **Seminar in Romance Linguistics.** Same as Italian, Linguistics, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: French 362 or consent of instructor. 1 unit.
463. **College Teaching of Foreign Languages.** Same as English as a Second Language, German, Russian, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
467. **Old Provençal Historical Grammar.** Phonology, morphology, and syntax of the Old Provençal language with emphasis on its Latin origins; illustrative reading of selected prose works; and lectures in English. Prerequisite: Consent of instructor. 1 unit.

468. **Old Provençal Literature.** Selected readings of various genres, emphasizing lyric poetry and with attention to its position in European literature; lectures in English. Prerequisite: French 467 or consent of instructor. 1 unit.
470. **Seminar in Old French Literature.** Discussion and research on some specialized topic in Old French literature; topic announced in advance. Prerequisite: French 450. 1 unit. May be repeated for credit.
471. **Seminar in Sixteenth-Century French Literature.** Discussion and research on some specialized topic in sixteenth-century French literature; topic announced in advance. 1 unit. May be repeated for credit.
472. **Seminar in Seventeenth-Century French Literature.** Discussion and research on some specialized topic in seventeenth-century French literature; topic announced in advance. 1 unit. May be repeated for credit.
473. **Seminar in Eighteenth-Century French Literature.** Discussion and research on some specialized topic in eighteenth-century French literature; topic announced in advance. 1 unit. May be repeated for credit.
474. **Seminar in Nineteenth-Century French Literature.** Discussion and research on some specialized topic in nineteenth-century French literature; topic announced in advance. 1 unit. May be repeated for credit.
475. **Seminar in Literary Themes and Types.** Same as Comparative Literature 481. Study of a theme or type (the Faust myth, the romantic hero, etc.) to discover its essential components in all the literatures studied and the significance of national variation; subject varies each semester. 1 unit. May be repeated to a total of 3 units.
478. **Seminar in Twentieth-Century French Literature.** Same as Comparative Literature 478. Discussion and research on some specialized topic in twentieth-century French literature; topic announced in advance. 1 unit. May be repeated for credit.
479. **Seminar in French Literature.** Discussion and research on some specialized area in French literature; topic announced in advance. 1 unit. May be repeated for credit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as English as a Second Language, German, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: French 463 or consent of instructor. 1 unit.
482. **Seminar in French and Comparative Cinema.** Same as Comparative Literature 473. Study of major French directors within the context of French and international cinema; their comparison with selected non-French directors; and the relationships of films and other literary forms. 1 unit.
485. **Seminar in Proust, I.** Prerequisite: French 342 or consent of instructor. ½ unit. Offered in 1974-75 and in alternate years.
486. **Seminar in Proust, II.** Prerequisite: French 342 or consent of instructor. ½ unit. Offered in 1974-75 and in alternate years.
491. **Individual Topics.** Prerequisite: Graduate standing with a major or minor in French. ¼ to 1 unit.
499. **Thesis Research.** 0 to 4 units.

GENERAL ENGINEERING

Head of Department: Professor J. S. Dobrovolny

Department Office: 117 Transportation Building, Urbana

101. **Engineering Graphical Communication.** Conveying ideas by means of freehand sketches; orthographic projection including auxiliary views; isometric and oblique pro-

- jections; dimensioning; geometric and positional tolerancing; specification of materials; use of national standards; and charts and diagrams. Credit is not given for both General Engineering 101 and General Engineering 103 or 105. Prerequisite: Fulfillment of college mathematics requirements. 3 hours.
103. **Engineering Graphics, I.** Integrated course in engineering graphics for all students in the College of Engineering. Freehand sketching; theory of orthographic projection and the analysis and synthesis of theoretical and practical problems involving the size, shape, and/or relative positions of common geometrical magnitudes such as points, lines, planes, and other surfaces and solids; theory of pictorial projections; basic dimensioning; and basic charts and diagrams. Credit is not given for both General Engineering 103 and General Engineering 101 or 105. 3 hours.
104. **Engineering Project Design Methodology.** An introductory course covering the methods, techniques, and practice of engineering project design. Individual and team effort design projects are carried out from the proposal, through the development, evaluation, and report phases. Emphasis is placed upon creativity, scheduling and planning, economic factors, and communication processes. Suitable for all students with an interest in engineering and engineering administration. Prerequisite: General Engineering 103 or equivalent, or consent of instructor. 3 hours.
105. **Elements of Drawing.** Theory, techniques, terms, symbols, and conventional practices used in making various types of projection and nonprojection drawings with instruments and freehand. For students in the aircraft maintenance curriculum. Credit is not given for both General Engineering 105 and General Engineering 101 or 103. Prerequisite: High school plane geometry. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **History of Engineering.** Survey of the major contributions of the science and art of engineering from prehistory to the present; integrates the impact of engineering with the cultural aspects of the various periods. Prerequisite: Junior standing or consent of instructor. 3 hours.
221. **Introduction to General Engineering Design.** Fundamental concepts involved in design problems and in production methods in construction; practice in cost analysis, planning, consideration of materials, and engineering computations involved in analysis of engineering design problems. Prerequisite: General Engineering 103 and 104, or credit or concurrent registration in Theoretical and Applied Mechanics 150. 3 hours.
222. **Analysis of Dynamic Systems.** Introduction to the operational techniques used in describing the behavior of dynamic systems; elements of modeling; equilibrium and linearization; Laplace transformation techniques; system response via the transfer function; block diagrams and computer simulation; matrix operations; system response via state variables; and stability. Prerequisite: Mathematics 345; concurrent registration in Computer Science 101. 3 hours.
230. **Engineering Aspects of Contemporary Society.** Survey of twentieth-century engineering developments; the application of present-day engineering capabilities in cooperation with other disciplines to selected major problems of society. Prerequisite: Senior standing or consent of instructor. 3 hours.
232. **Engineering Analysis, II.** Study of stress conditions in various engineering materials and configurations as applied to the development of design criteria. Prerequisite: Theoretical and Applied Mechanics 221. 4 hours.
241. **Component Design.** Application of principles and methods of analysis to design of basic engineering components utilizing the common engineering materials. Prerequisite: General Engineering 232; Theoretical and Applied Mechanics 224. 4 hours.
242. **Project Design.** Design of various engineering projects emphasizing the synthesis of the subject matter covered in previous courses in basic sciences, engineering sciences, analysis, engineering economics, and component design. Prerequisite: General Engineering 241 and 288. 3 hours.
282. **Introduction to Patent Law.** Survey of the U.S. Patent System, including a brief history; requirements of patentability; patent procedures; employer-employee relations;

trade secrets; infringement and remedies; copyrights; trademarks; unfair competition; and antitrust considerations. 2 hours.

288. **Economic Analysis for Engineering Decision Making.** Introduction to economic and operational analysis in the engineering decision-making process; mathematics of capital budgeting, mathematical programming, systems analysis, and the application of probability and simulation to decision making. Prerequisite: Junior standing or consent of instructor. 3 hours.
290. **Legal Aspects of Engineering Contracts and Specifications.** Same as Civil Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; and business and technical clauses of specifications. Credit is not given for both General Engineering 290 and 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
291. **General Engineering Seminar.** Series of lectures and discussions by department faculty and visiting professional engineers on ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. Prerequisite: Senior standing in general engineering. 0 credit.
292. **Engineering Law.** Nature and development of the legal system; legal relationships, rights and duties, and their importance in the engineering profession; and contracts, torts, agency, business transactions, and liability for defective products. Credit is not given for both General Engineering 290 or Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in engineering or architecture, or consent of instructor. 3 hours.
293. **Special Problems.** Individual investigations or studies of any phase of general engineering selected by the students and approved by the department. Prerequisite: Junior standing; consent of instructor. 0 to 4 hours.
304. **Professional Expression.** Reading and critical study of significant authors from Plato to W. H. Whyte, selected for their contributions to intellectual breadth, imagination, and perfection of style. Original projects allow coordination with seminar and other content courses, and permit the mature student to gain any needed knowledge of reports, administrative correspondence, and articles for publication. Prerequisite: Advanced or graduate standing and consent of instructor. 3 or 4 hours, or 1 unit.
330. **Industrial Standardization.** Evolution and history of standardization; local, national, and international standardization; and emphasis on standardization procedures for individual industrial establishments. Prerequisite: Junior standing or consent of instructor. 2 hours or ½ unit.
334. **Introduction to Reliability Engineering.** Same as Industrial Engineering 334. Introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 333 or Mathematics 361, or equivalent with consent of instructor. 3 hours, or ¾ or 1 unit.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, Geography, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution including such topics as the health effects and economic damage, and the political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or ½ unit.
360. **Engineering Applications of Meteorological Fundamentals.** Application of the fundamentals of meteorology to engineering problems including the transport and diffusion of particulate matter, aerosols, and gases; precipitation processes and rain-out; behavior of stack effluents; and explosion debris. Prerequisite: Physics 106 and 107; Mechanical Engineering 205 and 206, or 209, or Chemistry 342 and 344, or Physics 360; senior standing in engineering or physical science. 4 hours or 1 unit.
393. **Special Problems.** Study of advanced problems related to general engineering. Prerequisite: Senior standing and consent of instructor. 1 to 4 hours, or ¼ to 1 unit.

GEOGRAPHY

Head of Department: Professor J. Thompson

Department Office: 220 Davenport Hall, Urbana

102. **Atmospheric Environment.** Introduction to the processes responsible for the spatial variation of weather and climate with a survey of world climatic patterns. 4 hours.
103. **Earth's Physical Systems.** Systems approach to the physical environment, including landform, soil, vegetation, and animal elements; man's role as an ecological dominant. 4 hours.
104. **Geographic Perspectives on Human Behavior.** The geographic structure of the world; natural, human, and cultural regional patterns and their interrelations; and man's occupation of the natural environmental regions of the world. 4 hours.
105. **Introductory Economic Geography.** Geographic analysis of the distribution of various kinds of economic activity; an examination of the patterns resulting from man's exploitation of the world's resources; and emphasis placed on the principles governing the location of mineral, manufacturing, and commercial activities. 4 hours.
185. **Introduction to Social Statistics.** Same as Sociology 185. First course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.
195. **Undergraduate Honors Seminar.** Through discussions and research projects, the seminar is designed to provide an in-depth understanding of topics in the field of systematic or regional geography which are selected for group study. Appropriate geographic methodology is emphasized. Prerequisite: James Scholar standing or other designation as a superior student. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Interaction Between Man and Nature.** Interactions between man and the ecosystem through time and across cultures, and the spatial patterns evolving from these interactions. Prerequisite: Enrollment as a participant in three-year degree study. 3 or 6 hours.
210. **Geography in World Affairs.** Discussions of the role played by various physical and cultural geographic patterns in past and contemporary world and national affairs. 3 hours.
211. **Agricultural Climatology.** Climatic elements and controls; types of climate; graphic and cartographic representation of climatic data; and macroclimates and microclimates in relation to agriculture. 3 hours.
214. **Conservation of Natural Resources.** Elements of the conservation of natural resources (soils, water, biotic, mineral, recreational), with emphasis on the general principles of conservation as they apply to the United States. 3 hours.
223. **Geography of Anglo-America.** Occupance patterns of the United States and Canada; regions of Anglo-America; and United States and Canada in world relations. 3 hours.
241. **Historical Geography of Europe.** Evolution of occupance patterns of Europe from the origin of Mediterranean landscapes through the Industrial Revolution. 3 hours.
272. **Introductory Field Geography.** Application of fundamental geographical field techniques to field mapping; develops field mapping skills, permits practical application of geographical principles, and provides a basic understanding of field procedures; and an introduction to advanced field geography for the student who later seeks an advanced degree. 5 to 8 hours.
295. **Independent Study in Geography.** Supervised independent study of special topics or regions; required for students graduating with departmental distinction. Prerequisite: At least one formal course in the topic or region of interest; consent of instructor. 2 to 4 hours. May be repeated once for credit.

297. **Scope and Purpose of Geography.** Seminar on the nature of geography; a brief history of the discipline, and an examination of its methodology, content and emerging trends. Strongly recommended for students planning graduate work in geography. 2 hours.
303. **Advanced Physical Geography.** Systematic analysis of the basic elements of physical geography and their interaction through time and surface expression, including the modifying effects of man. Complementary to Geology 301. Prerequisite: Consent of instructor. 4 hours or 1 unit.
305. **Zoogeography.** Introduction to the principles of zoogeography; the central theme explains present distribution of animals, chiefly mammals. Prerequisite: Geography 102 and 103, Geology 102, or Zoology 104, or consent of instructor. 3 hours or 1 unit.
306. **Maps and Cartobibliographical Aids.** Examination of the problems involved in the acquisitions, care, and library use of maps. Classes become familiar with the major cartobibliographical and related aids. 2 hours, or $\frac{1}{2}$ or 1 unit.
312. **Atmospheric Ecology.** Elementary survey of the physical causes of climate as it is observed on all scales of time and space; the climate of the world seen as process; interactions of plants, animals, and humans with the atmosphere; and selected current topics on the atmosphere and general ecoseptematics. Prerequisite: Junior standing and consent of instructor. 3 hours or 1 unit.
313. **Climates of the Continents.** Regional treatment of the climates of the world by continents. Prerequisite: Geography 102 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **Regional Problems in Conservation of Natural Resources.** The distribution, use, and interrelationships of the resources in the various resource management regions of the United States, the conservation techniques applied to them, and the problems of public policy in their effective management. 3 hours or $\frac{3}{4}$ unit.
321. **Regional Concepts of Geography.** Theories of regionalism; nature of the geographic region; unique position of regionalism in a total geographic philosophy; and regionalism in applied geography. 2 hours or $\frac{1}{2}$ unit.
323. **Geography of the North American Midwest.** The core of the North American continent; detailed analysis of the functions and patterns of the Midlands and their external relations. 3 hours or $\frac{3}{4}$ unit.
325. **Historical Geography of North America.** Changing patterns of spatial organization in the United States and Canada, circa 1400 A.D. to 1870; focus on changing landscape patterns through time, perception of relict landscapes in the present day, and contemporary preservation of historic areas. 3 hours or 1 unit.
331. **Geography of Caribbean America.** Survey of the physical elements and occupancy sequences that distinguish the geographic regions of Mexico, Central America, Panama, and the West Indies. 3 hours or $\frac{3}{4}$ unit.
332. **Geography of South America.** Regional geography of South America with emphasis on the southern hemisphere of that continent. 3 hours or $\frac{3}{4}$ unit.
342. **Geography of Europe.** Influence of the climate, surface features, and natural resources on the distribution of the people, and their industries and routes of trade; new boundaries and present economic problems in their geographic setting. 3 hours or $\frac{3}{4}$ unit.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, General Engineering, Mechanical Engineering, Urban Planning, and Veterinary Medical Science 348. Interdisciplinary seminar on air pollution, including such topics as the health effects and economic damage, and the political, legal, urban planning, and engineering implications of air pollution as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or $\frac{1}{2}$ unit.
351. **Geography of Asia.** Regional geography of Asia with concentration on the monsoon realm of southern and eastern Asia. 3 hours or $\frac{3}{4}$ unit.
353. **Geography of the U.S.S.R.** Physical and cultural regionalism; a survey of natural resources and patterns of human occupancy including industry, agriculture, and transportation. 3 hours or $\frac{3}{4}$ unit.
355. **Geography of Central and South Africa.** Regional geography of Africa south of the Sahara. 3 hours or $\frac{3}{4}$ unit.

357. **Geography of the Middle East and North Africa.** Regional geography of an area with limits largely defined in terms of Arab and Moslem influence or closely related cultural and historical circumstances; oriented around the strategic centrality of the core of the territory as the crossroads of Europe, Asia, and Africa. 3 hours or $\frac{3}{4}$ unit.
361. **Geography of Agricultural Land Utilization.** Geographic consideration of the nature of agricultural land utilization from the world, continental, and regional viewpoints; special emphasis on the geographical implications of various types of agricultural land use and upon the interrelationships between areas of different types of land utilization. 3 hours or $\frac{3}{4}$ unit.
362. **Geography of Manufacturing.** Analysis of factors bringing about geographical concentration of industry; description and analysis of each of the major manufacturing regions of the world in terms of the geographic conditions which have influenced its location and products. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
363. **Geography of Minerals.** Geographic aspects of the mineral industries. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
365. **Geography of Transportation.** Consideration of the agents of transportation (land, water, air), the routes of transportation, transportation terminal complexes, and the basic commodity exchange services of transportation within the framework of their regional and interregional relationships. 3 hours or $\frac{3}{4}$ unit.
366. **Location of Industry and Other Economic Activities: Theory and Practice.** Location-al theory applied to the relationship between geographic facts of relief, climate, resources, population, and transportation and the industrial location process; case studies in the effects of transportation networks and rate, sources of materials, labor supply, location of markets, etc., on the selection and evaluation of industrial sites; and study of factors affecting location of stores and other commercial activities. 3 hours or $\frac{3}{4}$ unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Health Education, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.
370. **Quantitative Methods in Geography.** Geographical applications of statistical and mathematical research techniques. Prerequisite: Geography 185, one year of college mathematics, or one course in statistics, or equivalent. 3 hours or $\frac{3}{4}$ unit.
371. **Introduction to Research.** Introductory training in bibliographical and cartographic techniques as source materials of geographic research. Prerequisite: Geography major. 3 hours or $\frac{3}{4}$ unit.
373. **Map Compilation and Construction.** Instruction and practice in the basic techniques of map making followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed); the selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. 4 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Health Education, Physiology, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Geography 369. 4 hours or 1 unit.
378. **Descriptive Interpretation of Remote Sensors.** Descriptive interpretation of remote-sensing images with emphasis on interpretation of aerial photography; applications of aerial photography and photographic interpretation to the solution of problems in the

major field of the individual student. Two half-day field trips on Saturdays. 4 hours or 1 unit.

381. **Russian Culture History and Ethnology.** Same as Anthropology 381. Historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Siberian Culture History and Ethnology.** Same as Anthropology 382. Ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Urban Geography.** Distribution, functions, and internal structures of cities; a geographic analysis and classification of urban centers and their tributary areas. 3 hours or $\frac{3}{4}$ unit.
384. **Interaction in the Geographical Environment.** Human interaction in social and geographic spaces; introduction to interaction models in social geography and to mechanisms of information flow that underlie the human spatial interaction processes; and detailed consideration of the social and spatial dimensions of individual action spaces and of theories of migration. 3 hours or 1 unit.
385. **Perception of the Geographical Environment.** Introduction to the study of environmental perception, especially the parameters of human spatial awareness; focus on proxemic behavior and human space needs, space searching and locational decisions, and symbolic value in landscape and place preferences. 3 hours or 1 unit.
386. **Political Geography.** World patterns of nations in relation to their natural environmental backgrounds: European nations, the exploited continent of Africa, Asian national structures, and Western Hemisphere nations. 3 hours or $\frac{3}{4}$ unit.
412. **Analytical Climatology.** Detailed consideration of the character and causes of the climates of certain selected areas; the application of various criteria as bases for climatic differentiation. Prerequisite: Geography 111; Geography 313 or equivalent; consent of instructor. 1 unit.
429. **The Evolution of Agricultural Economies.** Same as Agronomy 429 and Anthropology 429. Problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
463. **Historical Geography.** Objectives and methods of historical geography. 1 unit.
471. **Advanced Research Concepts.** Development of research strategies for geographic studies; examination of contemporary geographic theory from the standpoint of both application and policy-oriented research. Prerequisite: Geography 371. $\frac{1}{2}$ unit.
473. **Problems in Cartography.** Subjects for map presentation are selected in the student's field of specialization or area of interest. Data are collected and maps compiled and carried to completion in final drafted form suitable for publication. Prerequisite: Geography 373 or consent of instructor. 1 unit.
477. **Area Analysis.** Individual analysis of areas in the vicinity of Urbana. 1 unit.
478. **Advanced Field Geography.** Graduate course in the theory and application of geographical field techniques to the analysis of areas, culminating in individual reports on assigned problems in the field course area. Prerequisite: Graduate standing in geography. 1 $\frac{1}{4}$ to 2 units. Offered in the summer session only.
495. **Advanced Studies in Geography.** Directed and supervised detailed investigation of selected problems or regions; designed to develop ability to conduct independent investigation. $\frac{1}{2}$ to 2 units. Work may be taken in the following sections: (a) physical geography, Africa, agricultural origins; (b) medical geography, Australia and New Zealand, quantitative geography; (c) Asia, resource management, transportation; (d) urban geography, U.S.S.R.; (e) Middle East, advanced cartography; (f) Anglo-America, political geography, regionalism; (g) economic geography, industrial location, Europe; (h) Europe, marketing geography; (i) human ecology, U.S.S.R.; and (j) Latin America.

497. **Development of Geographic Thought.** Consideration of the various philosophies of geography and of the men who reflect them. $\frac{1}{2}$ unit.
499. **Thesis Research.** 0 to 4 units.

GEOLOGY

Head of Department: Professor F. A. Donath

Department Office: 249 Natural History Building, Urbana

101. **Physical Geology.** Materials, structures, surface features of the earth, and processes which have produced them; lectures, quiz, and laboratory. One half-day field trip required; estimated cost, \$2.00. 4 hours.
102. **Historical Geology.** Evolution of the earth and its life; lectures and laboratory. One-day field trip required; estimated cost, \$5.50. Prerequisite: Geology 101, 105, 142, or 250. 4 hours.
105. **Agricultural Geology.** Principles of physical geology with emphasis on those useful to students of agriculture. One-half day field trip; estimated cost, \$2.00. For agricultural students only. Prerequisite: One semester of chemistry. 4 hours.
111. **Honors: Physical Geology.** A two-day field trip is required. Prerequisite: Concurrent registration in the honors section of Geology 101, James Scholar standing, or consent of instructor. 1 hour.
112. **Honors: Historical Geology.** A two-day field trip is required. Prerequisite: Concurrent registration in the honors laboratory of Geology 102, James Scholar standing, or consent of instructor. 1 hour.
115. **Regional Field Study.** Field observations in a region of diverse geology. One- to two-week field trip. Credit is given only on completion of a satisfactory written report. Prerequisite: Geology 101, 105, 142, or 250. 2 hours.
142. **Earth Evolution and Chemical Environments.** Same as Liberal Arts and Sciences 142. A physical science course for nonscience majors, presenting a general discussion of the origin and evolution of the earth, its continents and ocean basins, and basic chemical aspects of the earth's ecologic systems, including water and air pollution, radiation chemistry, and the use of pesticides in nature. 4 hours.
143. **Environmental Physical Science.** Same as Liberal Arts and Sciences 143. A physical science course for nonscience majors with emphasis on earth processes and resources relevant to modern society; attempts to place in perspective the physical limitations imposed by earth, by discussing the physical nature of the environment and the basic principles that apply within it. Specific topics include matter and energy, availability, pollutant levels, and conditions for a stable environment. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
215. **Field Geology.** Field course to be conducted from a suitable geologic locality; introduction to field techniques, geologic mapping, and field training in stratigraphy, structure, and geomorphology. Prerequisite: Geology 102; consent of instructor. 8 hours. Offered in the summer session only.
222. **Paleontology and Stratigraphy.** Systematic study of fossils, their classification and morphology, and general principles of stratigraphy. Not open to students in geology. Students may not receive credit for both Geology 222 and 320. Prerequisite: Geology 102. 4 hours.
233. **Minerals and Rocks.** Systematic study of minerals and rocks with emphasis on their nature as crystalline materials, their occurrence and geologic relationships, and their economic significance. Prerequisite: Chemistry 101 or Geology 102, or consent of instructor. 4 hours.
250. **Geology for Engineers.** Physical geology with an emphasis on those aspects of the natural environment which are of importance to the engineer. Prerequisite: Theoretical

and Applied Mechanics 150 or 152; sophomore standing in the College of Engineering. 3 hours.

290. **Research and Thesis.** Individual work under supervision of members of the staff in their respective fields. The research may lead to a bachelor's thesis, which is one requirement for graduation with departmental distinction. Each student who desires to register in this course must present to the head of the department a written statement from the instructor under whom he is to work. Credit to be arranged.
301. **Geomorphology.** History, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion or by a combination of these acting upon the major kinds of geologic materials and structures. Lectures, laboratory, and field trips. Prerequisite: Geology 102. 4 hours or 1 unit.
303. **History of Geology.** Development of the fundamental concepts of the geological sciences from classical to modern times. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit.
309. **Sedimentology.** Introduction to principles of sediment erosion, transport, and deposition; origin of sediment texture, sedimentary structures, sedimentary sequences, sediment mineralogy, and diagenesis; and sediment deposition in fluvial, deltaic, deep water, tidal flat, continental shelf, and beach and barrier island environments. Prerequisite: Geology 102 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
310. **Field and Laboratory Procedures in Sedimentology.** Introduction to the field and laboratory study of Holocene sediments and sedimentary rocks, with emphasis on field sampling, sieve-size analysis, peel making of unconsolidated sediments and sedimentary rocks, x-ray radiography, disaggregation of sediments, heavy mineral analysis, mineral identification by staining, pH-Eh determinations, and thin-section preparation. Required field work. Must be taken concurrently with Geology 309. Prerequisite: Geology 102. 1 hour or $\frac{1}{4}$ unit.
311. **Structural Geology.** Rock deformation and its results. Lectures, laboratory, and one two-day field trip. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit.
315. **Advanced Field Methods.** Mapping a structurally and/or stratigraphically significant area of moderate size and difficulty; preparation of a report. Prerequisite: Geology 215. 2 to 8 hours, or $\frac{1}{2}$ to 2 units. Unit credit to be determined.
320. **Invertebrate Paleontology.** Fossil groups in the biological sequence. Lectures and laboratory. Students may not receive credit for both Geology 320 and 222. Prerequisite: Geology 102. 4 hours or 1 unit.
321. **Principles of Stratigraphy.** Definition of stratigraphic units, correlation, facies, paleogeography, and historical inference; techniques of physical stratigraphy. Prerequisite: Geology 102. 4 hours or 1 unit.
325. **Paleobotany.** Same as Botany 325. Structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. Prerequisite: Botany 100, or Biology 100 and 101; Geology 101; or consent of instructor. 5 hours or 1 unit.
332. **Mineralogy-Petrology.** Introduction to the structure, chemistry, and stability of the major silicate minerals and their occurrence in rocks. Prerequisite: Geology 102; Chemistry 102 or 108. 4 hours or 1 unit.
335. **Optical Mineralogy.** Study of crystalline matter, especially minerals, by polarized light microscopy and powder x-ray diffractometry. Prerequisite: Geology 332. 4 hours or 1 unit.
336. **Igneous and Metamorphic Petrography.** Study of the constituents, composition, texture, structures, and classification of igneous and metamorphic rocks; laboratory study of rocks in hand specimen and thin section. Prerequisite: Geology 335. 4 hours or 1 unit.
338. **Introduction to Sedimentary Petrography.** Introduction to the microscopic study of sedimentary rocks in thin section with emphasis on their textural properties as a basis for their classification and environmental interpretation. Prerequisite: Geology 335. 2 hours or $\frac{1}{2}$ unit.

350. **Theoretical Geophysics.** Introduction to the major fields of theoretical geophysics: figure of the earth, thermodynamics of the earth, gravity, seismology, magnetism, and planetary geophysics. Prerequisite: Mathematics through calculus; one year of physics; Geology 311; consent of instructor. 4 hours or 1 unit.
351. **Geophysical Prospecting.** Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
357. **Glacial and Pleistocene Geology.** Consideration of glacial flow, erosion, and deposition; stratigraphic analysis of glacial deposits and correlation of Pleistocene glacial successions with nonglacial sediments. Prerequisite: Consent of instructor. 4 hours or 1 unit.
360. **Chemistry of the Earth.** Study of geochemical processes; origin and distribution of elements and isotopes in rocks, sediments, and natural waters. Prerequisite: Geology 332. 4 hours or $\frac{3}{4}$ unit.
370. **Oceanography.** Principles of biological, chemical, geological, and physical marine science. Prerequisite: Botany 100 or Zoology 104; Chemistry 101, Geology 101, and Physics 101; or consent of instructor. 4 hours or 1 unit.
415. **Regional Field Geology.** Field study of critical localities within a geologic province during a period of two or three weeks; discussion of observations and preparation of reports in which the concepts and principles mastered in graduate study are applied to regional geologic synthesis. Prerequisite: Consent of instructor. 1 unit.
420. **Paleoecology.** Interpretation of life habit of fossil organisms from skeletal morphology and associated depositional features; reconstruction of marine ecosystem relationships from the study of assemblages of fossils. Prerequisite: Geology 320 or equivalent. 1 unit.
421. **Advanced Invertebrate Paleontology.** Intensive study of a selected invertebrate group. Prerequisite: Geology 320 or Zoology 320. 1 unit. May be repeated for credit.
422. **Stratigraphic Geology: Paleozoic.** The concept of the Paleozoic era and its periods, series, stages, and zones; evaluation of the type sequences and the succession of faunas; and problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit.
423. **Stratigraphic Geology: Mesozoic.** The concept of the Mesozoic era and its periods, series, stages, and zones; evaluation of the type sequences and the succession of faunas; and problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit.
424. **Stratigraphic Geology: Cenozoic.** The concept of the Cenozoic era and its periods, series, stages, and zones; evaluation of the type sequences and the succession of faunas; and problems of correlation and historical inference. Prerequisite: Geology 322. 1 unit.
425. **Micropaleontology: Benthonic Foraminifera.** Classification, biology, and distribution in time and space of benthonic foraminifera; emphasis on ecology and evolution. Prerequisite: Geology 320 or Zoology 320, or Zoology 318. 1 unit.
426. **Micropaleontology: Ostracoda.** Morphology, classification, ontogeny, and phylogeny of fossil and living ostracoda; study of stratigraphic, paleoecologic, and ecologic distribution, and of soft-part morphology. Prerequisite: Geology 320 or Zoology 320. 1 unit.
427. **Micropaleontology: Conodonts.** Morphology and history of conodonts, chitinozoans, and lesser groups with emphasis on use in biostratigraphy and paleogeography. Prerequisite: Geology 320 or Zoology 320; consent of instructor. 1 unit.
428. **Micropaleontology: Plankton.** Classification and distribution of major groups of shelled oceanic plankton: foraminifera, radiolaria, coccolithophores, diatoms, and others; emphasis on biostratigraphic use of these fossils. Prerequisite: Geology 320, or Zoology 320 or 318; consent of instructor. 1 unit.
431. **Structural Mineralogy.** Principles of the crystal chemistry and structural classification of minerals; survey of the current knowledge about the structures and structurally dependent properties and behavior of representative minerals and mineral groups. Prerequisite: Consent of instructor. 1 unit.
432. **Sedimentary Geochemistry.** Equilibrium assemblages among the principal organic and inorganic sedimentary solids and their associated liquids during weathering, deposition, and diagenesis; kinetics and mechanism of phase changes; and transport proc-

esses during diagenesis. Prerequisite: Geology 360 or equivalent, or consent of instructor; some background in physical chemistry desirable. 1 unit.

434. **Theoretical Petrology.** Use of thermodynamic and kinetic arguments in the solution of basic petrological problems. Prerequisite: Consent of instructor. 1 unit.
436. **Metamorphic Petrology.** Problems in metamorphism and advanced studies of metamorphic rocks. In the laboratory, selected rock suites are studied and special methods of investigation are covered. 1 unit.
437. **Sedimentary Processes.** Application of fluid mechanics to quantitative analysis of erosion, transport, and deposition by open channel flow, waves, tidal currents, longshore currents, turbidity currents, wind, and ice; quantitative determination of origin of physical sedimentary parameters and sedimentary mineralogy; and processes of weathering and diagenesis. Prerequisite: Geology 335 or equivalent, or consent of instructor. 1 unit.
438. **Sedimentary Petrography.** Microscopic study of sedimentary rocks in thin section with emphasis on textures and structures as a basis for their detailed classification and genetic interpretation. Prerequisite: Geology 335 and 437. 1 unit.
443. **Mineral Deposits.** Principles of mineral deposition and genesis of mineral deposits. Prerequisite: Geology 311. 1 unit.
450. **Principles of Engineering Geology.** Study of the effects that lithology, weathering, joints, faults, and ground water have upon engineering projects. The origin, exploration, description, analysis, and significance of geologic factors are studied and illustrated with case histories. A three-day field trip is an integral part of the course. Prerequisite: Geology 250 or equivalent, or consent of instructor. 1 unit.
451. **Practice of Engineering Geology.** Study of current and past case histories that illustrate the applications of the principles of engineering geology; includes studies where lithology, weathering, joints, faults, and ground water have influenced the exploration, design, construction, and maintenance phases of engineering projects. A three- or four-day field trip to visit engineering construction projects is an integral part of the course. Prerequisite: Geology 450 and Civil Engineering 383, or consent of instructor. 1 unit.
455. **Hydrogeology.** Geology of the occurrence, storage, movement, and quality of water in the rocks of the earth's crust. Prerequisite: Consent of instructor. 1 unit.
456. **Advanced Hydrogeology.** Geologic aspects of regional flow and ground water development with emphasis on geologic description and modeling of ground water systems. Prerequisite: Geology 455. 1 unit.
461. **Mineralogy of Clays.** Same as Ceramic Engineering 461. Composition of various types of clays; the structure and properties of the clay minerals; and the origin and mode of occurrence of the clay minerals and clay materials. Prerequisite: Geology 336 or equivalent; consent of instructor. 1 unit.
462. **Mineralogy of Clays.** Same as Ceramic Engineering 462. Properties of clay materials, their relation to the structure of the clay minerals, and methods of determination and control; the utilization of clays in various arts and industries. Prerequisite: Geology 461. 1 unit.
471. **Submarine Geology.** General geology of the ocean basins and continental margins, with emphasis on the geological interpretation of marine geophysical investigations. Prerequisite: One year of physics or consent of instructor. 1 unit.
477. **Recent Sedimentary Environments.** Review of sedimentary processes, physical sedimentary parameters, and sedimentary mineralogy in fluvial, lake, dune, beach, barrier island, bar, deltaic, tidal flat, lagoonal, bay, marsh, continental shelf, continental margin, submarine fan, submarine canyon, and deep ocean floor environments; sedimentological aspects of land usage, and conservation and preservation of man's environment. Prerequisite: Geology 437 or consent of instructor. 1 unit.
479. **Statistical Geology.** Analysis of the geologic assumptions necessary to fulfill mathematical requirements in numerical analysis of geologic problems. Prerequisite: Mathematics 161 or Agronomy 340; Computer Science 101; consent of instructor. 1 unit.

488. **Advanced Structural Geology.** Analysis of geologic deformation based upon the principles of mechanics and utilizing research data from laboratory and field investigations; methods in structural analysis. Prerequisite: Geology 311 or consent of instructor. 1 unit.
489. **Geotectonics.** Nature and distribution of major earth structures and geological and geophysical evidence bearing on their origin. Prerequisite: Geology 311 or consent of instructor. 1 unit.
493. **Advanced Studies in Geology.** $\frac{1}{4}$ to 2 units. Work may be taken in the following fields: (a) clay mineralogy; (b) engineering geology; (c) geomorphology and glacial geology; (d) general geology; (e) ground-water geology; (f) micropaleontology; (g) mineral deposits; (h) mineralogy and crystallography; (i) paleontology; (j) geochemistry; (k) geophysics; (l) petrography and petrology; (m) sedimentology; (n) stratigraphy; (o) oceanography; (p) submarine geology; (q) structural geology and geotectonics; and (r) mathematical geology.
499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

GERMANIC LANGUAGES AND LITERATURES

(Including German, Germanic, and Scandinavian)

Head of Department: Professor E. H. Antonsen

Department Office: 3072 Foreign Languages Building, Urbana

German

101. **Elementary Course.** Oral practice, reading, and grammar for beginners. All students are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **Elementary Course.** Continuation of German 101. All students are required to register for one hour of work weekly in the language laboratory. Prerequisite: One semester of college German or equivalent. 4 hours.
103. **Intermediate Course.** Continuation of German 102. All students are required to register for one hour of work weekly in the language laboratory. Prerequisite: Two semesters of college German or equivalent. 4 hours.
104. **Intermediate Course.** Continuation of German 103. All students are required to register for one hour of work weekly in the language laboratory. Prerequisite: Three semesters of college German or equivalent. 4 hours.
112. **Elementary Speaking.** Practice in speaking idiomatic German. Prerequisite: One semester of college German or equivalent. 4 hours.
113. **Intermediate Speaking.** Continuation of German 112. Prerequisite: Two semesters of college German or equivalent. 4 hours.
114. **Intermediate Speaking.** Continuation of German 113. Prerequisite: Three semesters of college German or equivalent. 4 hours.
122. **Elementary Reading.** Practice in reading German, with emphasis on expository prose. Prerequisite: One semester of college German or equivalent. 4 hours.
123. **Intermediate Reading.** Continuation of German 122. Prerequisite: Two semesters of college German or equivalent. 4 hours.
124. **Intermediate Reading.** Continuation of German 123. Prerequisite: Three semesters of college German or equivalent. 4 hours.
134. **Introduction to Literature.** Discussion in English of German literature read in the original. With German 135, this course satisfies the graduation requirement in the College

- of Liberal Arts and Sciences. Prerequisite: Three semesters of college German or equivalent. 3 hours.
135. **Introduction to Literature.** Continuation of German 134. With German 134, this course satisfies the graduation requirement in the College of Liberal Arts and Sciences. Prerequisite: Four semesters of college German or equivalent. 3 hours.
153. **Practice in Conversation.** Emphasis on learning to converse in German in an everyday manner. Prerequisite: Two semesters of college German or equivalent. 2 hours.
164. **Practice in Writing.** Practice in using simple, idiomatic German in short essays; stylistic analysis of model texts. Prerequisite: Three semesters of college German or equivalent. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **German Literature Since 1648 in English Translation.** Same as Humanities 210. Important trends in German literature since 1648; reading of some important prose works. For students with no knowledge of German. 3 hours.
202. **Society in the Novel.** No knowledge of German required. Portrayal of society in German novels from 1648 to the present; reading and discussion of works by Grimmelshausen, Goethe, Hoffmann, Fontane, Thomas Mann, Hesse, Kafka, and Grass. 3 hours.
203. **Goethe in Translation.** Same as Comparative Literature 203. Introduction to the life and works of Wolfgang Goethe; focus on his poetic work, and also treatment of his major contributions to science as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as Comparative Literature 204. German medieval precourtly and courtly literature in translation; readings in the works of Hartmann, Gottfried, Wolfram, Walther, and others, including the following epics: Nibelungenlied, Gregorius, Tristan, and Parzival. 3 hours.
208. **German Source Readings from the History of Science.** Reading and discussion of eighteenth- and nineteenth-century contributions to physics, chemistry, and biology which are basic in the respective disciplines. Prerequisite: German 104 or four years of high school German. 3 hours.
210. **Masterpieces of German Literature.** Introduction to German literature, its subjects, forms, and ideas. Prerequisite: Two years of college German or equivalent. 3 hours.
211. **Conversation and Writing.** Prerequisite: German 103 and 113, or 104, or equivalent. 3 hours.
212. **Conversation and Writing.** Continuation of German 211. Prerequisite: German 211 or equivalent, or consent of instructor. 3 hours.
250. **The German Novelle of the Nineteenth Century.** Prerequisite: German 210 or equivalent. 3 hours.
251. **The German Novelle of the Twentieth Century.** Prerequisite: German 210 or equivalent. 3 hours.
252. **Nineteenth-Century German Drama.** Selected works of Kleist, Hebbel, and Grillparzer; their eighteenth-century roots, and their background in classical drama. Prerequisite: German 210 or equivalent. 3 hours.
253. **Twentieth-Century German Drama.** Modern German drama from Hauptmann to the present. Prerequisite: German 210 or equivalent. 3 hours.
260. **Lyrics and Ballads.** Poetical and metrical survey of German lyric verse from its beginnings to modern times, with a critical analysis of representative poems. Prerequisite: German 210 or equivalent. 3 hours.
270. **Twentieth-Century German Literature.** Introduction to trends of modern civilization as reflected in contemporary German literature. Prerequisite: German 210 or equivalent. 3 hours.
280. **Teachers' Course.** Introduction into the problems of the teaching of German and a study of textbooks. Prerequisite: Senior standing or consent of instructor. 4 hours.
290. **Selected Topics.** Introductory study in such topics as individual authors, selected literary movements or periods, modes of inquiry in literary study, minor genres, subgenres, extraliterary influences, etc. Prerequisite: Reading fluency in German beyond the fourth-semester college level. 3 hours.

291. **Senior Thesis and Honors Course.** Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 to 4 hours.
292. **Senior Thesis and Honors Course.** Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 to 4 hours.
300. **German Literature 750-1450.** Literary, thematic, cultural, and bibliographical analysis of the major authors, works, genres, and movements in German literature from 750 to 1450. Prerequisite: German 210 and one other course in German literature or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
301. **German Literature 1450-1700.** A literary, thematic, cultural, and bibliographical analysis of the major authors, works, genres, and movements in German literature from 1450 to 1700. Prerequisite: German 210 and one other 300-level course in German literature, or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **German Literature Since 1700.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
303. **Advanced Conversation, Composition, and Syntax.** Intensive study of advanced problems of grammar, syntax, and style. Prerequisite: German 211 and 212, or equivalent. 3 hours or $\frac{1}{2}$ unit.
304. **Advanced Conversation.** Practice in free conversation with native speaker. Prerequisite: German 303 or equivalent. 1 hour or 0 unit.
305. **Modern German Poetry.** A poetical and metrical survey of modern German lyric verse. Prerequisite: German 210 and one other course in German literature, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
306. **Contemporary German Poetry.** Poetical and metrical survey of contemporary German lyric verse. Prerequisite: German 305 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Goethe.** Introduction to Goethe's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
312. **Goethe's Faust.** Intensive study of Goethe's Faust, Parts I and II. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
320. **History of German Civilization.** Selected topical, historical, and pictorial analysis of Germany's culture and civilization. Prerequisite: German 210 and one other course in German literature, or equivalent. 4 hours or $\frac{3}{4}$ unit.
330. **Martin Luther.** Same as Religious Studies 330. Special attention to Luther as an artist, and to his importance for the development of German language and literature; attention also paid to the historical and intellectual trends of the fifteenth and sixteenth centuries as well as to the significance of Luther in modern psychological and sociological thought. Prerequisite: A reading knowledge of German. 3 hours or $\frac{3}{4}$ unit.
331. **The Age of Lessing.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
332. **Schiller.** Introduction to Schiller's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
351. **German Abroad, I.** Lectures, seminars, and practical work in language, literature, education, and civilization, in Austria. Prerequisite: German 212 or equivalent; 3.75 overall average; 4.0 in German courses. 0 to 16 hours, or 0 to 2 units.
352. **German Abroad, II.** Lectures, seminars, and practical work in language, literature, education, and civilization, in Austria. Prerequisite: German 351. 0 to 16 hours, or 0 to 2 units.
365. **German Phonology and Morphology.** Introductory survey of the phonological and morphological structure of the German language. Prerequisite: Three years of college German or equivalent. 3 hours or $\frac{3}{4}$ unit.

382. **Language Laboratory Techniques.** Same as French, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level, or equivalent. 2 hours or $\frac{1}{2}$ unit.
392. **Topics in German Literature.** Intensive study of individual authors or other restricted topics in German literature. Prerequisite: Two advanced courses in German literature. 4 hours, or $\frac{3}{4}$ or 1 unit.
394. **Introduction to Methodology of Myth and Folklore.** Same as Comparative Literature 394, Slavic 394, English 387, and Speech 346. Prerequisite: One year of college literature or consent of instructor. 3 hours or 1 unit.
400. **Beginning German for Graduate Students.** Introduction to the reading of German texts in the sciences and the humanities. 4 semester hours. No graduate credit.
401. **Readings in German for Graduate Students.** Designed for graduate students preparing for the German reading requirements for the Ph.D. Prerequisite: German 400 or equivalent. 4 semester hours. No graduate credit.
411. **Proseminar.** Methods of literary criticism and research. To be taken concurrently with German 495. 1 unit.
412. **Proseminar.** Methods in German language study. Prerequisite: German 365 or equivalent. 1 unit.
415. **Middle High German.** Prerequisite: German 365. 1 unit.
416. **Middle High German Literature.** Prerequisite: German 415 or equivalent. 1 unit.
420. **History of the German Language.** Prerequisite: German 365. 1 unit.
441. **German Romanticism.** 1 unit. Offered in 1975-76 and in alternate years.
442. **Nineteenth-Century German Realism.** German realism as manifested in the literature between romanticism and naturalism, with emphasis on so-called poetic realism. Prerequisite: German 301 and 302, or equivalent. 1 unit. Offered in 1975-76 and in alternate years.
445. **Old High German.** Grammar and interpretation of the oldest literary documents. Prerequisite: German 365. 1 unit.
447. **Old Saxon.** Synchronic-diachronic treatment of the language of the Heliand and Genesis; the position of Old Saxon in the Germanic languages with particular reference to Old High German and Old English. Prerequisite: German 445 or English 401. 1 unit.
451. **Naturalism, Symbolism, and Expressionism.** Same as Comparative Literature 441. German literature from the 1880s to the 1920s. 1 unit.
452. **German Literature from the Twenties to the Present.** Trends, problems, and personalities in contemporary German literature. Prerequisite: German 301 and 302, or equivalent. 1 unit.
460. **Seminar in Older German Literature.** Prerequisite: German 411 and 495. 1 unit.
461. **Seminar in Modern German Literature.** Same as Comparative Literature 482. Prerequisite: German 411 and 495. 1 unit.
462. **Seminar in Literary Genres and Forms.** Same as Comparative Literature 461. Study of a form (the lyric, the novel, the drama, etc.) to discover its essential components in all the literatures studied and the significance of national variations. 1 unit. May be repeated for a total of 3 units as topic varies.
463. **College Teaching of Foreign Languages.** Same as French, Russian, Spanish, and English as a Second Language 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
480. **Teaching German in College.** Introduction to the problems of teaching German in college. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, Russian, Spanish, and English as a Second Language 481. Language teaching problems considered in the light of theoretical and experimental work in language

acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: German 463 or consent of instructor.

- 493. **Research in Special Topics.** ¼ to 2 units. May be repeated for a maximum of 2 units.
- 495. **Bibliography and Methods in Literary History.** To be taken concurrently with German 411. ½ unit.
- 499. **Thesis Research.** 0 to 4 units (summer session, 0 to 2 ½ units).

Germanic

- 367. **Introduction to German Linguistics.** Same as Linguistics 367. Comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent; some knowledge of German desirable. 2 hours or ½ unit.
- 426. **Gothic.** Introduction to Germanic (comparative) linguistics. Prerequisite: Germanic 367 or consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.
- 462. **Seminar in Germanic Linguistics.** Problems in diachronic and descriptive Germanic linguistics. Prerequisite: Consent of instructor. 1 to 2 units.
- 465. **Comparative Germanic Phonology and Morphology.** Reconstruction of the phonological and morphological systems of Proto-Germanic and their development into the Germanic languages and dialects. Prerequisite: Germanic 426 or consent of instructor. 1 unit.
- 467. **Runology.** Detailed analysis of inscriptions in the "older" Germanic futhark, the Anglo-Frisian futhorc, and the Scandinavian "younger" futharks; their relationships and the correlation between phonological and orthographic developments. Prerequisite: Germanic 465 or consent of instructor. 1 unit.

Scandinavian

- 101. **Elementary Scandinavian, I.** The first of four semesters leading to a reading knowledge of Danish, Norwegian, and Swedish, and to an oral command of one of these languages; linguistic structure, reading, and oral practice. 4 hours.
- 102. **Elementary Scandinavian, II.** Continuation of Scandinavian 101. Structural differences between Danish or Swedish and Norwegian; oral practice and reading of simple texts. Prerequisite: Scandinavian 101. 4 hours.
- 103. **Intermediate Scandinavian, I.** Readings in Danish and Norwegian (or Swedish) literature; structure of Swedish (or Danish and Norwegian), with stress on the differences between Swedish and Danish. Prerequisite: Scandinavian 102 or equivalent. 4 hours.
- 104. **Intermediate Scandinavian, II.** Continuation of Scandinavian 103. Readings in classical and modern Danish, Norwegian, and Swedish texts. Prerequisite: Scandinavian 103. 4 hours.
- 199. **Undergraduate Open Seminar.** 0 to 9 hours.
- 216. **Conversation and Writing.** Oral practice and composition in one of the Scandinavian languages. Prerequisite: Scandinavian 104. 2 hours.
- 297. **Senior Thesis and Honors Course.** Prerequisite: Senior standing; consent of instructor. 1 to 2 hours.
- 361. **Ibsen.** Same as Humanities 361. Dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit.
- 362. **Strindberg and the Later Scandinavian Dramatists.** Same as Humanities 362. Major dramas and prose works of August Strindberg in translation; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Pär Lagerkvist. 3 hours or 1 unit. Offered in 1974-75 and in alternate years.

405. Old Norse-Icelandic, I. Grammar and selected readings. 1 unit. Offered in 1975-76 and in alternate years.
406. Old Norse-Icelandic, II. Readings; selections from the Elder Edda and the sagas. Prerequisite: Scandinavian 405. 1 unit. Offered in 1975-76 and in alternate years.

GREEK

(See Classics)

GREEK, MODERN

(See Linguistics)

HEALTH AND SAFETY EDUCATION

Head of Department: Professor W. H. Creswell, Jr.

Department Office: 117 Huff Gymnasium, Champaign

Health Education

110. **Public Health.** Basic principles of group living including epidemiology studies; scientific methods as applied to environmental health in urban and rural areas; and specialized programs. Field trips. Prerequisite: Two hours credit in health education or sophomore standing. 2 hours.
150. **Health and Modern Life.** Dynamics of health in modern life in a rapidly changing world; modern concepts of health, disease, and longevity; current health problems, issues, and trends; scientific health facts, principles, and theories related to personal, family, and community health; and health and longevity progress in the United States. Designed primarily as a professional course for prospective health and safety educators, coaches, physical educators, and recreation workers. Prerequisite: Credit or concurrent registration in Zoology 104, or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Mental Health.** Introduction to the science of mental health and illness including personality development, the genesis and manifestations of mental illness, and the maintenance of mental health; taught by a psychiatrist with emphasis on the preventive and medical aspects of mental health. 2 hours.
206. **Sex Education and Family Life.** Offered to persons who are interested in becoming more critical and obtaining a larger perspective in their understanding of the problems of sex and family life. Prerequisite: Junior standing or consent of instructor. 2 hours.
216. **Medical Terminology Correlated with Community Health Problems.** A preprofessional course for those entering the occupational therapy curriculum, medical journalism, and paramedical fields. Occupational therapy students are given priority the fall semester. Prerequisite: Junior standing; enrollment in the occupational therapy curriculum. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the students. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of

- faculty adviser and instructor, and approval of the head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours.
260. **Honors Seminar.** Same as Physical Education 290, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours.
281. **First Aid.** American Red Cross standard course in first aid. 2 hours.
282. **Organization of School Health Programs.** Developing school health programs, including health service, healthful school living, and health instruction based on the needs and problems of school children. 3 hours.
283. **Man and His Diseases.** Ecologic, including cultural, factors affecting disease in man; changing concepts of disease; epidemiology of communicable and noncommunicable diseases; and disease prevention and control. Designed primarily for prospective health teachers in the high schools and colleges and public health educators. Prerequisite: Health Education 110 and 150; Physiology 103. 2 hours.
285. **Sex Education for Teachers.** Theory and practice of family life and sex education; basic issues, philosophy, and guiding principles; needs and objectives; scope and sequence; methods and materials; basic content and concepts; unit and lesson preparation; curriculum construction; evaluation procedures; and Illinois law, family life, and sex education programs. Prerequisite: Advanced standing. 3 hours.
288. **Principles of Health Education.** History, scope, needs, and principles underlying the school health program. Prerequisite: Health Education 282. 3 hours.
289. **Health Education Field Work.** Supervised field experiences in official, voluntary, and professional health agencies; designed to give students in community health work experience in actual field situations. During the junior or senior year, students work for one semester in University-approved health agencies for a minimum of sixty hours of field work. Prerequisite: Junior standing in community health education. 2 hours.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Physiology, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology; emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environments, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Physiology, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Health Education 369. 4 hours or 1 unit.
390. **Public Health Education.** Theory and practice of community health education; adult health education through media such as radio, television, films, slides, posters, pamphlets, and newspapers; projects in preparing and using public health education materials; and evaluation of research in public health education. Prerequisite: Senior or graduate standing in health education, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
391. **Health Data Analysis.** Introduction to public health statistics including collection and classification of data; rates and other indices; measures of central tendency and dispersion; tests of significance; and use of vital statistics in planning, conducting, and evaluating public and school health education programs. Prerequisite: Mathematics 161 or Educational Psychology 390, or equivalent. 2 hours or $\frac{1}{2}$ unit.
392. **Health and Safety Education in the Elementary School.** Overview of the school health program to acquaint the teacher with modern concepts of health and safety education in the elementary school; consideration of the role of the classroom teacher in under-

standing and meeting the health needs of children; and focus on the legal requirements for Illinois schools, major health and safety problems of elementary children, the teacher's role in the school health program, and methods and materials in teaching modern health and safety education. Prerequisite: One year of biological science. 3 hours or $\frac{1}{2}$ unit.

393. **Drug Abuse Education.** Psychosocial, pharmacological, and legal aspects of drug use and abuse; school and community responses to drug abuse; and the development of appropriate curricula, materials, and teaching strategies for combatting drug use and abuse. Prerequisite: Six hours of health education or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
400. **Scientific Foundations of Health Education.** Designed to reinforce and extend the student's knowledge of pertinent scientific health facts and principles as these apply to further improvement of personal, family, and community health. Prerequisite: Undergraduate courses beyond the elementary level in the biological and physical sciences and in health education. $\frac{1}{2}$ or 1 unit.
401. **Problems in School Health Education.** History, philosophy, principles, and practices of school health education in its three main phases: health service, healthful school environment, and health instruction, including evaluation. $\frac{1}{2}$ or 1 unit.
403. **Problems in Public Health.** Basic facts and principles of public health at the local, state, and national levels, including the relationships between public health departments, voluntary health agencies, and the school health program. $\frac{1}{2}$ or 1 unit.
404. **Trends and Issues in Sex Education.** Critical analysis of current trends and basic issues of sex education; study of present status of sex education in the United States and selected foreign countries; and a critical analysis of philosophy, principles, methods, and current problems in sex education. Prerequisite: Undergraduate courses beyond the elementary level in the biological and social sciences, Health Education 285 or equivalent, or consent of instructor. $\frac{1}{2}$ or 1 unit.
490. **Seminar.** Student presentation of thesis reports in health and safety education; informal discussions, lectures, and critical analysis of current problems in health and safety education. Prerequisite: Health Education 495. 0 credit.
493. **Special Projects.** Independent research on special projects. $\frac{1}{2}$ to 2 units.
495. **Research Methods in Health and Safety Education.** Special emphasis on research orientation and methods; experimental design; processing and analysis of data; selection of research problems and preparation of thesis; and current research literature in health and safety education. Prerequisite: Educational Psychology 390 or equivalent. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Preparation of theses in health and safety education. Prerequisite: Health Education 495. 0 to 4 units.

Safety Education

199. **Undergraduate Open Seminar.** 0 to 9 hours.
280. **Safety Education.** Understanding and appreciating the place of safety in modern life; the teaching of safety in the elementary and secondary schools; need for psychological considerations; planning and methods of teaching; safe school environment and liability; materials; safety education for elementary and secondary schools; a safety program for areas outside the school; human experience; and testing and evaluating. 3 hours.
284. **Driver Education.** Cause and extent of highway accidents; laws and regulations; method of instructing high school students in the proper attitudes, habits, and skill in driving; demonstrations and practice in the use of a dual control car; and psychophysical testing equipment. Prerequisite: Up-to-date driver's license; junior standing; proficiency in driving automatic and standard transmission vehicles. 3 hours.
289. **Safety Education Field Work.** Supervised field experiences in official, voluntary, and professional safety agencies; designed to give students in public safety education work

experience in actual field situations. During the junior or senior year or during the summer, students work for one semester in University-approved safety agencies for a minimum of sixty hours of field work. Prerequisite: Senior standing in public safety education. 0 credit.

294. **Advanced Traffic Safety Education.** Designed to provide advanced preparation in principles and practices of driver and traffic safety education for teachers, supervisors, and administrators; includes a study of the relationship of psychology, sociology, and engineering to driver education and traffic safety; modern methods and materials; traffic legislation and enforcement; laboratory work with various psychophysical tests; and a critical consideration of current research findings. Field trip and two hours per week laboratory to be arranged. Prerequisite: Safety Education 284 or consent of instructor. 3 hours.
384. **Simulated Teaching Systems for Traffic Safety.** Development of conceptual foundations and the acquisition of skills in the use of multimedia teaching; includes laboratory experiences in the use of multiple-care driving facilities, simulated driving systems, and electronic classroom systems; analysis and review of the traffic safety education problem and its relationship to multimedia instruction programs; role of multimedia instruction in traffic safety; analysis and review of multimedia instruction techniques; use of multimedia in the teaching-learning process; research and analysis of research in the use of driving simulators and multiple-care driving range instruction; and development of conceptual foundations and acquisition of skills in the use of multimedia facilities. Prerequisite: Safety Education 284. 3 hours, or ½ to 1 unit.
394. **Special Topics.** Lecture and laboratory experiences of current interests and issues; specific subject matter will be announced in the Timetable. 2 to 4 hours, or ½ to 1 unit. May be repeated to a maximum of 8 hours or 2 units.
402. **Problems in Safety Education.** Philosophy of safety: traffic, recreation, home, and industrial safety facts and figures; the safety problem and its relation to education; organization of safety education programs; methods of teaching; legal aspects; and research problems. ½ or 1 unit.

HEBREW

(See Classics)

HEBREW, MODERN

(See Linguistics)

HIGHER EDUCATION

Acting Program Coordinator: Professor F. D. Carver

Program Office: Room 341 Armory, Champaign

199. **Undergraduate Open Seminar.** 0 to 9 hours.
267. **The American College.** A survey of the American college and university; its history, structures, problems, trends, and governance. Provides an opportunity to explore the nature and scope of higher education in the United States. 3 hours.

442. **The Junior College.** Same as Vocational and Technical Education 442. The place of the junior college in the modern program of public education; social, economic, and other changes responsible for development of postsecondary education as found in junior colleges, area vocational schools, and technical institutes. 1 unit.
443. **The College Student.** Study of the characteristics and development of college students, the institutional contexts in which they operate, and the interaction of students with the college environment. 1 unit.
449. **Independent Study.** Offers self-directive, independent study, that is, develops the individual's ability as an independent student, and enables the student to pursue needed study in a field in which appropriate courses are not offered during a given semester. Prerequisite: Approval of study outline by adviser and the division chairman prior to enrollment. $\frac{1}{2}$ to 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
451. **Issues in Higher Education.** Seminar on current issues, problems, and trends in higher education. Prerequisite: Two units in higher education or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
467. **The American College and University.** Introduction to higher education as a subject: its history, purposes, leaders, and literature; attention to conceptual framework in which further development of this subject can progress. 1 unit.
475. **Administration of Higher Education.** Administrative practices, procedures, and arrangements for policy implementation in the American college (including the community college) and university; special attention given to the roles of major administrative officers. Prerequisite: Higher Education 442 or 467, or equivalent. 1 unit.
477. **Student Personnel Work in Higher Education.** Study of theoretical foundations and principles underlying the practice of student personnel work; investigation of the role and function of student personnel workers in terms of their relationship to various goals, philosophies, issues, trends, and research. 1 unit.
478. **The Administration of Student Personnel Work.** Structural arrangements for meeting student-oriented needs in the American college (including the junior college) and university; attention to the role of the chief administrative officer for student affairs. Prerequisite: Higher Education 477 or equivalent. 1 unit.
479. **Organization and Control of Higher Education.** Organizational patterns whereby colleges and universities seek to accomplish their purposes; agencies involved in the control of higher education. Prerequisite: Higher Education 442 or 467, or equivalent. 1 unit.
480. **Internship in the Administration of Higher Education.** Designed to provide supervised direct experience in the administration of higher education; with the aid of the faculty in higher education, students select the institution and position most relevant to their career goals. No more than 2 units may be offered toward an advanced degree. Prerequisite: Consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Open only to students who have been admitted for doctoral study in higher education. Sections are offered in the following fields: philosophy of higher education, current problems of higher education, and history of higher education. Prerequisite: Higher Education 442 or 467, or consent of instructor. 1 unit.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Individual direction of research and thesis writing. Prerequisite: Admission as a doctoral candidate in higher education. 0 to 4 units (summer session, 0 to 2 units).

HINDI

(See Linguistics)

HISTORY

Chairman of Department: Professor R. M. Sutton

Department Office: 309 Gregory Hall, Urbana

111. **History of Western Civilization to 1815.** Europe from the age of the great discoveries to the close of the Napoleonic Wars. 4 hours.
112. **History of Western Civilization, 1815 to the Present.** Development of European nationalism, liberalism, and imperialism; world wars; and reconstruction. 4 hours.
131. **History of England to 1688.** Survey of the political and constitutional, social and economic, church and cultural, and imperial history of the British people from the beginning of English history through the revolution of 1688. 4 hours.
132. **History of England, 1688 to the Present.** Survey of the political and constitutional, social and economic, diplomatic and imperial, and cultural history of the British people from 1688 to the present. 4 hours.
151. **History of the United States to 1877.** Colonial foundations, movement for independence, and early years of the republic. Students are not given credit for both History 151, and History 260 and 261. 4 hours.
152. **History of the United States, 1877 to the Present.** A century of national life and organization. Students are not given credit for both History 152 and 262. 4 hours.
168. **Indian Civilization and Society.** Same as Anthropology 168. Introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as Anthropology 169. Interdisciplinary introduction to modern South Asian history and society. 4 hours.
171. **History of East Asia, I.** Survey of the development of Chinese and Japanese history, civilization, and institutions prior to the seventeenth century. 4 hours.
172. **History of East Asia, II.** Survey of China and Japan in modern times with particular reference to the modernization and revolutionary processes in East Asia. Prerequisite: History 171. 4 hours.
173. **Islamic History and Civilization in the Near and Middle East to 1770.** Development of Islamic beliefs, institutions, and culture in the nuclear Islamic region (the present area of the Arab countries and Israel, Iran, and Turkey) from Mohammed to the age of European expansion. 4 hours.
174. **Islamic History and Civilization in the Near and Middle East Since 1700.** Islamic civilization since the age of European expansion; imperialism, Westernization, nationalism, and modernization. Arab countries, Israel, Iran, and Turkey are covered. 4 hours.
181. **The Ancient World.** Ancient empires and Greece. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
182. **The Ancient World.** Rome. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
198. **Freshman Seminar.** Through research, reports, and discussion in a selected field of historical study, the seminar provides an in-depth understanding of the problems of that field and of the methodology of history as a discipline. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 to 4 hours. May be repeated to a total of 6 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.

203. **The Age of Localism: The Early Middle Ages.** The failure of imperial Rome and the rise of the Church; the organization of European society on a local basis through manorialism and feudalism. 3 hours.
204. **The Revival of Europe: The High and Later Middle Ages.** The revival of the economy; the expansion of Europe; and the rise of national states. 3 hours.
211. **The Contemporary World: Political, Ideological, and International Forces.** Interpretation of the contemporary world covering the legacy of imperialism, militarism, and world politics, the revolt of the masses, the totalitarian state, nationalism, internationalism, and such related topics. 3 hours.
212. **The Contemporary World: Economic, Social, and Cultural Aspects.** Interpretation of the contemporary world covering the economics of global power, ideological and social forces, the individual and the modern mind, the collective society, the personality in history, and such related topics. 3 hours.
215. **History of North and West Africa.** Survey of major themes and events in the history of North and West Africa from prehistoric times and the peopling of Africa through the advent of Islam; North and West African empires and states in the medieval period; the arrival and departure of European colonial powers; and the re-emergence of independent African states. 3 hours.
216. **History of East and Southern Africa.** Survey of major themes and events in the history of East and Southern Africa from prehistoric times and the Bantu migrations through the expansion of Islam; east coast commercial traditions; the arrival of European traders; settler and colonial interests and their emergence; and the continuing efforts of other African peoples to achieve an independent status. 3 hours.
219. **Survey of Russian History from Early Times to the Present.** Main themes and problems of Russian history from earliest times to the present. Prerequisite: One year of college history or consent of instructor. 3 hours.
246. **Evolutionary and Social Thought Since 1800.** Study of evolutionary theory; the scientific and the social contexts in which it has developed; and the inferences drawn from it concerning man's nature and future. 3 hours.
247. **Science in Western Civilization, I.** The intellectual and social history of science from antiquity through the Enlightenment; special emphasis on the scientific revolution of the seventeenth century. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours.
248. **Science in Western Civilization, II.** Topics in the intellectual and social history of modern science, 1789 to present. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours.
253. **Afro-American History to 1877.** History of Africans in the Americas, surveying the African slave trade, slavery in the European colonies of the Americas, early United States slavery, and the Afro-American in the Civil War and Reconstruction. 3 hours.
254. **Afro-American History Since 1877.** History of Afro-Americans in the age of white supremacy; the rise of modern protest organizations; the era of integration; and the black power movement. 3 hours.
260. **Colonial Beginnings and Early United States History to 1815.** Social, economic, and political survey of the region and its relation to the evolving Atlantic community. Credit is not given for both History 260 and 151. 3 hours.
261. **The United States in the Nineteenth Century.** History of the United States from 1815 to 1900. Credit is not given for both History 261 and 151. 3 hours.
262. **The United States in the Twentieth Century.** One major emphasis on foreign policy, including the emergence of the United States as a great power after 1898; a second emphasis on the Progressive movement and recurrent attempts at the reform of American society; and racial and urban problems and the conservation of natural resources included. Credit is not given for both History 262 and 152. 3 hours.
271. **French Colonization of North America, 1500-1778.** Exploration and settlement of New France; the British administration of the West to the capture of Kaskaskia by G. R. Clark. Prerequisite: One year of college history. 3 hours.

272. **History of European Women.** Status of women in Europe, cross-culturally and by class, from ancient to modern times; exploration of the contributions of women as individuals and as groups to the distinctive development of Europe's national cultures. Prerequisite: One year of European history or consent of instructor. 3 hours.
274. **U. S. and World Crisis, 1917 to Present.** History of American foreign relations since World War I. 3 hours.
275. **History of Latin America to 1824.** Survey of Latin American history from the discovery of America until 1824. Prerequisite: One year of college history. 3 hours.
276. **History of Latin America Since 1824.** History of the Latin American republics from their independence to the present; emphasis on Argentina, Brazil, Chile, Colombia, Cuba, and Mexico. Prerequisite: One course in college history. 3 hours.
290. **Teaching of History.** Prerequisite: One year of college history; senior standing. 2 hours.
293. **Thesis.** Two-semester independent research project. Prerequisite: History major with senior standing and 4.0 grade-point average; written consent of the honors adviser. May be taken by honors students in partial fulfillment of department honors requirements. 3 hours. May be repeated for a total of 6 hours.
295. **Reading Course.** Readings in selected fields in consultation with the instructor. Prerequisite: Junior or senior of high standing; written consent of the honors adviser. May be taken by honors students in partial fulfillment of department honors requirements. 2 to 4 hours.
298. **Colloquium in History.** Prerequisite: Enrollment as history major or history teacher trainee; senior standing. 3 hours.
303. **The Near and Middle East in the Twentieth Century.** Great power diplomacy, imperialism, nationalism, and problems of modernization studied through coverage of Arab states and Israel, Turkey, and Iran. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
304. **Medieval Civilization.** Same as Religious Studies 304. Religious and intellectual. Prerequisite: One year of college history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
305. **The Age of the Renaissance.** Same as Religious Studies 305. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **The Age of the Protestant and Catholic Reformation, 1500-1648.** Same as Religious Studies 306. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as Religious Studies 307. The Near East under the Arab caliphs; political, institutional, and intellectual development of Islam. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **The Europeanization of the Near East, 1768-1914.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
309. **Development of Modern Europe: Absolutism and Colonial Expansion, 1648-1789.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **The Development of Modern Europe: The French Revolution and Napoleon, 1789-1815.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
311. **European History from 1815 to 1871.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
312. **European History from 1871 to 1918.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **European History from 1918 to 1939.** Survey of European society from 1918 to 1939, with emphasis on the impact of World War I, the Russian Revolution, fascism, and the intellectual trends of the twenties and thirties. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
314. **European History from 1939 to the Present.** Survey of European society since 1939, with emphasis on the impact of World War II, the Cold War, the establishment of the

welfare state, and social developments. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

315. **Economic and Social History of Europe to 1815.** History and analysis of the development of European economy and society from the Middle Ages to the Industrial Revolution; evolving agrarian systems; growth of commercial economies; industrial and technical progress; and colonial expansion. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
316. **The Industrial Revolution in Europe, 1780-1900.** Comparative analytic study of industrial development in England, France, Germany, and Russia; social, cultural, and demographic consequences of rapid economic change. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **Europe and the World Economy Since 1880.** Economic development of Europe within world economy to the present; topics include imperialism and international finance; World War I and Great Depression; Soviet development; recovery since 1945; and Europe and the underdeveloped world. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Modern European Diplomatic History, 1789-1890.** Diplomatic history of Europe from the French Revolution to the fall of Bismarck. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
319. **Modern European Diplomatic History, 1890 to the Present.** Diplomatic history of Europe from the fall of Bismarck to the present day. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
320. **Russia from the Earliest Times to Peter the Great.** Political, economic, cultural, and social development of Russia during the Kievan and Muscovite periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Russia from Peter the Great to 1855.** Political, economic, cultural, diplomatic, and social development of Russia during Imperial times. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
322. **European History, 1918 to the Present.** Major intellectual, social, economic, and political forces which have shaped the experience of twentieth-century Europeans. Credit is not given for History 322 and either History 313 or 314. Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
323. **Intellectual History of Modern Europe, 1513-1770.** Survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Intellectual History of Modern Europe, 1770 to the Present.** Survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
325. **Intellectual and Cultural History of Russia to 1825.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
326. **Intellectual and Cultural History of Russia from 1825 to the Present.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
327. **Russia from 1855 to the Bolshevik Revolution of 1917.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
328. **History of Soviet Russia, 1917 to the Present.** The founding and development of the Soviet regime, with emphasis on political, social, and institutional change since the Russian Revolution. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **History of Southeastern Europe from the Fourteenth to the Eighteenth Century.** The Byzantine heritage; the Ottoman conquest and its impact on the peoples of the Balkans; and the internal political and cultural history of the Rumanians, South Slavs,

- Greeks, and Albanians to 1804. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **History of Southeastern Europe Since 1804.** The rise of nationalism and the formation of national states in the Balkans; the decline of the Ottoman Empire; and the political and cultural history of Rumania, Yugoslavia, Bulgaria, Greece, and Albania in the nineteenth and twentieth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
332. **Medieval England.** Religious, social, intellectual, and economic developments in medieval England from the period of the Germanic invasions to the accession of the Tudors. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
333. **England Under the Tudors and Stuarts, 1485-1660.** The principal political, economic, social, religious, and cultural developments in English history from the beginning of the Tudor dynasty to the Restoration of 1660. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
334. **Great Britain Under the Later Stuarts and the Hanoverians, 1660-1815.** Principal political, economic, social, religious, and cultural developments in British history from the Restoration to the end of the Napoleonic wars. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **France, 1815-1900.** The development of France in its various aspects, with special attention to social problems. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
336. **France, 1900 to the Present.** Political, diplomatic, economic, social, and intellectual developments in France from 1900 to the present. Prerequisite: One year of history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Economic History of American Agriculture.** Same as Agricultural Economics 337 and Economics 337. The development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: College-level course in basic economics or American history. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **History of Cosmology.** History of man's changing conceptions of the structure and origin of the universe from the ancient creation myths to modern times; exploration of the relationship of cosmological theories to developments in the physical sciences, philosophy, and religion, and to social and cultural factors. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
341. **Modern Britain: the Victorian Era, 1815-1900.** History of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
342. **Modern Britain Since 1900.** History of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **The Turks and the Ottoman Empire, 1200-1566.** The Seljuk establishment; the Mongols and Ilhanids; Turkish principalities; the rise and conquests of the Ottomans; changing social and economic conditions; foreign relations with special attention to the Mamluks and Safavids; and the Ottoman establishment. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
344. **The High Ottoman Empire, 1566-1924.** The Ottomans and Islamic society; the Ottomans and Mediterranean society; Ottoman foreign relations and the development of diplomacy; the decline and dismemberment of the Empire; and traditional and westernizing attempts at revival. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Constitutional History of England to 1485.** Survey of English legal and constitutional development from about 600 to 1485, with emphasis on the ways in which social and economic development affected the constitution. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

346. **Constitutional History of England Since 1485.** Survey of English legal and constitutional development since 1485 with emphasis on the ways in which social and economic change affected the constitution. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
347. **The Age of Charlemagne.** Same as Classical Civilization 347. The age of Charlemagne and its intellectual, political, social, and cultural significance for western Europe. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
348. **Technology in American Life.** General, historical survey, including science and its interaction with American technology; emphasis on sources of technological innovation and the impact of technology on the economy, culture, and thought of America, from the colonial era to the present. 3 hours, or $\frac{1}{2}$ or 1 unit.
349. **The Scientific Revolution, 1543-1727.** Intellectual and social factors involved in the emergence of science in the late sixteenth and seventeenth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **History of American Immigration to 1880.** The migrations which peopled Colonial America and the United States and their role in the shaping of American society and culture. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
351. **History of American Immigration Since 1880.** The migrations of the late nineteenth and twentieth centuries and their impact on American society and culture. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
352. **Colonial Beginnings of American Life and Institutions.** Study of the seventeenth- and eighteenth-century colonies. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Afro-American Intellectual History.** Africa's importance in Afro-American thought; the ideology of liberation strategies; religion; education; and artistic expression, particularly the Harlem Renaissance, New Deal, and cultural manifestations of the 1960s and 1970s. Prerequisite: History 253 or 254, or one year of American history, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **The Era of the American Revolution, 1763-89.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Federalists, Jeffersonians, and the Era of Good Feeling.** United States history from 1789 to 1828, with emphasis on the conflict between nationalism and sectional interests. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **America in the Age of Jackson.** Political, social, and cultural study of the United States from the 1820s to the 1850s, including the rise of sectionalism, manifest destiny, and the Mexican War. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **Economic History of the United States, 1775-1860.** Growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **Economic History of the United States Since 1860.** Growth of American economic life and institutions since 1860. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **Civil War and Reconstruction.** Study of the United States between 1850 and 1877, including the causes of the Civil War, the wartime problems of the North and South, and the efforts to create a new Union following the Civil War. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
360. **History of the United States, 1877-1909.** Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **History of the United States, 1909-32.** Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
362. **History of the United States Since 1932.** Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
363. **Social History of Industrial America to 1918.** The impact of industrialization, immi-

- gration, and urbanization on American society to the end of World War I. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.
364. **Social History of Industrial America Since World War I.** Study of the impact of industrial technology, business enterprise, immigration, and urbanization of American society. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.
365. **The History of Illinois to 1870.** Evolution of a typical midwestern commonwealth with emphasis upon its political, economic, social, religious, and cultural development in the nineteenth century. Prerequisite: One year of college history or consent of instructor. 2 hours or ½ unit.
366. **The History of Illinois from 1870 to the Present.** Evolution of a modern American state with emphasis upon its political life, economic growth, social and intellectual problems, and its contribution to the American nation. Prerequisite: One year of college history or consent of instructor. 2 hours or ½ unit.
367. **The Trans-Mississippi West.** History of western expansion since the Louisiana Purchase; the West in the general history of the United States; and western economic and political problems. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.
368. **Scientific Thought, II.** An historical and critical survey of the development of science and its philosophical interpretation from the death of Newton to the early twentieth century. Prerequisite: Philosophy 317. 3 hours or 1 unit.
369. **Constitutional Development of the United States to 1865.** Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit.
370. **Constitutional Development of the United States Since 1865.** Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit.
371. **American Thought and Culture, I.** Same as Religious Studies 381. The impact of fundamental ideas in shaping American culture, character, and institutions from the colonial beginnings to the mid-nineteenth century; emphasis on Puritanism, the Enlightenment, and romanticism, and on the interplay between religious, scientific, political, social, educational, and artistic thought in the life of the American people. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit.
372. **American Thought and Culture, II.** Same as Religious Studies 382. The impact of fundamental ideas in shaping American culture, character, and institutions from the mid-nineteenth century to the present; emphasis on the role of Darwinism and naturalistic thought; political, cultural, religious, and intellectual forces and their interrelations; the American university; the impact of science and technology; and the emergence of neoromanticism. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit.
373. **History of American Foreign Relations to 1917.** Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit.
374. **Imperialism, 1870-1919.** Study of the origins and nature of pre-World War I imperialism, using the comparative approach, with emphasis on Great Britain, the United States, and Japan. Prerequisite: One-year survey course in history. 3 hours, or ½ or 1 unit.
375. **Andean Countries of South America, 1808 to Present.** Modern histories of Colombia, Ecuador, Peru, Bolivia, and Chile; emphasis on common problems and diverse responses, from the wars for independence in the nineteenth century to the struggles for development in the twentieth. Prerequisite: One year of college history or enrollment in the Latin American studies program. 3 hours, or ½ or 1 unit.
376. **History of Mass Politics in Latin America.** Comparative historical treatment of mass political movements in twentieth-century Latin America stressing Chile, Peru, Brazil, Argentina, Mexico, Bolivia, and Cuba; social science concepts supplement the historical analysis of causes, leaders, followers, programs, tactics, and results of these movements. Prerequisite: One year of college history or enrollment in the Latin American studies program. 3 hours, or ½ or 1 unit.
377. **History of Modern Brazil, 1808 to the Present.** Problems of a neocolonial society; themes include family structure, slavery, imperialism, modernization, and the crisis of

traditional institutions. Prerequisite: One year of college history or enrollment in the Latin American studies program. 3 hours, or $\frac{1}{2}$ or 1 unit.

378. **History of Modern Mexico, 1765 to the Present.** The development of Mexico from the era of Bourbon reforms to the postrevolutionary present. Prerequisite: One year of college history or enrollment in the Latin American studies program. 3 hours, or $\frac{1}{2}$ or 1 unit.
379. **Slavery and Race Relations in Latin America.** Selected topics on Indians and Spaniards, white and blacks, emphasizing Mexico, the Caribbean, and Brazil. 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Europe and the 'Scramble for Africa'.** Analysis of the politics and economics of the European partition of Africa with particular reference to Britain, France, and Germany (1870-1900) and African responses to alien rule. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
381. **Ancient Greek States.** History of the Greek states from the earliest times to 334 B.C. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Alexander and His Successors.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **History of the Roman Republic to 44 B.C.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
384. **The Roman Empire.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **Topics in the History of Islam in Africa.** Designed for advanced students with working knowledge of Middle Eastern or Islamic history, sociology, anthropology, or politics who want to examine specific historical themes (such as religious and legal reform, reaction to conquest, and secularization in Islam) in the context of Africa. 3 hours, or $\frac{1}{2}$ or 1 unit.
386. **Topics in African History.** Designed for advanced students with a working knowledge of African history, sociology, anthropology, economics, or politics who want to examine specific historical themes such as literacy, social structure and state formation, religious movements, elites and reactions to European occupation, proto-nationalism, nationalism, and the colonial legacy. Prerequisite: History 215 and 216. 3 hours or 1 unit.
387. **Indian History and Civilization to 1707.** Development of Indian civilization to the British conquest; political evolution, religious and philosophical systems, society, art, and literature during Hindu and Muslim periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
388. **India in the Age of Imperialism.** Western impact on India from 1498 to 1900; rise of British raj; and national awakening and social change in Victorian India. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **India from Gandhi to Independence.** Growth of nationalism, emergence of Muslim separation, and struggle for independence under Gandhi and Nehru. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
390. **China Under the Ch'ing Dynasty.** The period of Manchu domination in China (1644-1912); emphasis on Chinese reactions to Western influences during the nineteenth century. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
391. **A History of China to 906 A.D.** History of the formative period of the Chinese state, society, and economy. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
392. **A History of China, 907-1644.** History of the early modern Chinese state and society prior to the Western impact. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
394. **Twentieth-Century China.** Chinese state and society in revolutionary transition; emphasis on the Nationalist and Communist revolutions and their results. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
395. **Premodern Japan.** Japanese history from its origins to 1800; evolution of the traditional society, stressing institutional and cultural problems of ancient and "feudal" Japan.

- Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
396. **Modern Japan.** Japanese history since 1800; institutional and cultural problems connected with modernization; continuity and change in the traditional order; Western pressure; the Meiji restoration; rise and fall of empire; and creation of a modern society. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
397. **History and Thought of Japanese Buddhism.** Same as Religious Studies 397. Japanese response to Buddhism and its influence on Japanese life and culture. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
399. **History and Thought of Chinese Buddhism.** Same as Religious Studies 399. The interaction of Buddhism with Chinese thought and institutions from its introduction to the present. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
411. **Seminar in Ancient History: Greece.** 1 unit.
413. **Seminar in Ancient History: Rome.** 1 unit.
415. **Seminar in Medieval History.** 1 unit.
417. **Seminar in Renaissance History.** 1 unit.
418. **Seminar in Reformation History.** 1 unit.
419. **Seminar in European History, 1648 to 1815.** 1 unit.
421. **Seminar in European History Since 1815.** 1 unit.
423. **Seminar in English History to 1688.** 1 unit.
425. **Seminar in English and British Empire History Since 1688.** 1 unit.
427. **Seminar in Russian History.** 1 unit.
441. **Seminar in Near and Middle Eastern History.** 1 unit.
443. **Seminar in South Asian History.** 1 unit.
445. **Seminar in East Asian History.** 1 unit.
448. **Seminar in African History.** Prerequisite: History 215, 216, and one upper-level African history course. 1 unit.
451. **Seminar in Early American History to 1789.** 1 unit.
453. **Seminar in American History Since 1789.** 1 unit.
461. **Seminar in Latin American History.** 1 unit.
471. **Seminar in the History of Science.** 1 unit.
476. **Problems in Medieval History.** 1 unit.
477. **Problems in Early Modern European History, 1300-1815.** 1 unit.
478. **Problems in European History since 1815.** 1 unit.
479. **Problems in English History before 1688.** 1 unit.
480. **Problems in English History since 1688.** 1 unit.
481. **Problems in Russian History.** 1 unit.
482. **Problems in Near and Middle Eastern History.** 1 unit.
483. **Problems in Chinese History.** 1 unit.
484. **Problems in Japanese History.** 1 unit.
486. **Problems in American History to 1830.** 1 unit.
487. **Problems in American History since 1815.** 1 unit.
496. **History of Historiography.** Introduction to the great historians from early times to the present. 1 unit.
497. **Reading Course.** Directed reading in special fields. Open only to students with a master's degree or equivalent, who are preparing for the preliminary examination in history and who need instruction in areas not provided by current course offerings. Prerequisite: Master's degree or equivalent; consent of instructor. 1 unit.
498. **Problems in the Teaching of College History.** Prerequisite: Candidate for Ph.D. degree in history. $\frac{1}{2}$ unit.
499. **Thesis Research.** Individual direction in research and guidance in writing theses for advanced degrees. 0 to 4 units.

HISTORY AND PHILOSOPHY OF EDUCATION

Chairman of Department: Professor C. J. Karier

Department Office: 363 Education Building, Champaign

199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Foundations of American Education.** Study of the problems of formulating and justifying aims and policies in American education; of designing and systematizing the school curriculum; of organization and support of the public school system; and of the teaching-learning process. Problems are examined in terms of relevant materials derived from sociology, social philosophy, and axiology. Prerequisite: For students not in elementary education, Secondary Education 101 or Vocational and Technical Education 101, and Psychology 100; for students in elementary education, Psychology 100 only. 2 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; and consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
300. **The History of Education.** Brief introductory survey of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance; emphasis on the relation of educational trends to broader social, economic, political, and intellectual movements. Prerequisite: Junior standing. 3 hours or ½ unit.
301. **Philosophy of Education.** Philosophical examination of selected educational issues; conveys a grasp of the complexities of the issues and some philosophical methods for dealing with them. 2 to 4 hours, or ½ to 1 unit.
302. **History of American Education.** The development of American education in relation to political, social, and cultural developments; attention to the influence of movements in the cultural environment upon evolving conceptions of educational theory and practice. 2 hours or ½ unit.
303. **Comparative Education.** Introduction to the cross-cultural, cross-national study of educational institutions and their relationship to society; focus on schooling in both developing and industrialized nations. Prerequisite: Consent of instructor. 2 hours, or ½ to 1 unit.
304. **Social Foundations of Education.** Introductory survey of the interrelationship between school and society, and of the impact on public education of the major social trends and forces operating in our society. 2 to 4 hours, or ½ to 1 unit.
305. **History of Educational Ideas.** Study of selected educational theorists and intellectual movements; provides familiarity with the major educational ideas of the past and historical perspectives on current issues and problems in education; and readings in such authors as Aristotle, Plato, Quintilian, St. Augustine, Loyola, Comenius, Rousseau, Pestalozzi, Froebel, Herbart, and Dewey. 2 to 4 hours, or ½ to 1 unit.
306. **Introduction to Aesthetic Education.** Philosophic introduction to the problems of teaching for critical judgment and appreciation; examination of materials from aesthetics, art history, and criticism for relevance to problems of aims, curriculum, organization, and teaching-learning; and attention to problems of interrelated arts and humanities programs. Designed for prospective teachers of art, music, literature, and related subjects. 2 to 4 hours, or ½ to 1 unit.
307. **Aesthetics, Mass Media, and Education.** Introduction to the philosophic problems of teaching for developing critical judgment and appreciation of the mass media; use of materials drawn from aesthetics, communication theory, and the social sciences if rele-

vant to the educational problems of aims, curriculum, organization, and teaching-learning. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

308. **Contemporary Movements in Philosophy of Education.** A survey of trends and schools of thought in contemporary philosophy of education, including systematic, pragmatic, analytic, and existentialist philosophies of education. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
315. **Sociology of Education.** Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods; main emphasis on present education in countries which share Western civilization. Prerequisite: Sociology 100 or Sociology 151. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **Anthropology of Education.** Same as Anthropology 385 and Educational Psychology 385. Introduction to the contribution of anthropology to the cross-cultural study of education, including discussion of material from representative cultures ranging from primitive social groups to present-day national states; special attention to education of minority ethnic and subordinate cultures; and emphasis on both informal and formal education as cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
386. **Education and International Relations.** Analysis of the role of education in international relations; emphasis on the policies and programs of the major aid-giving nations, the competition among these nations, and the results of foreign assistance programs in the developing countries. Prerequisite: History and Philosophy of Education 303 or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
400. **Problems of Educational Theory.** Analysis of the kinds of problems encountered in constructing an educational theory, and of relations between educational theory and other disciplines, especially philosophy and the social sciences. Prerequisite: History and Philosophy of Education 301 or 308, or equivalent; consent of instructor. 1 unit. May be repeated for credit.
401. **Modern Theories of Education.** Critical analysis of the theories of education represented by the work of Robert M. Hutchins, James Conant, and Ivan Illich. Prerequisite: History and Philosophy of Education 301 or equivalent; consent of instructor. 1 unit.
402. **Educational Movements in the Twentieth Century.** Historical study of significant educational trends during the past sixty years, with special reference to their influence on American education; an analytical examination of the principal transition movements in the last decade of the nineteenth century and of efforts to solve the problems since 1900. Prerequisite: Consent of instructor. 1 unit.
403. **The Historical Foundations of American Educational Thought.** Study of the evolution of educational theories and philosophies since the eighteenth century; particular reference to their impact upon educational developments in the United States; a broad view of the general growth of American educational thought; and attention to selected major educational theorists, or schools of thought, exploration of their fundamental ideas, and the relation of these ideas to significant intellectual currents in American culture. Prerequisite: Consent of instructor. 1 unit.
404. **Seminar in Educational Classics.** Reading and group discussion of a limited number of the most important writings in educational philosophy which have had a profound influence on the progress of educational thought and practice. Prerequisite: History and Philosophy of Education 305 or equivalent; consent of instructor. 1 unit.
405. **Foundations of Aesthetic Education.** Philosophical approach to the problems of teaching for appreciation in formal education; appraisal of the status of aesthetic education, its nature and function, and its relation to other types of education. Prerequisite: History and Philosophy of Education 306 or equivalent; consent of instructor. 1 unit.
406. **Seminar in the History of Education.** Intensive group study of a small number of selected problems to assist individual students to develop an understanding of and the ability to use the techniques of historical research in furthering such study; problems studied are selected in the light of the interests and previous training of the group of students enrolled. Prerequisite: Two courses in the history of education and one course

in the philosophy of education, or consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.

407. **Logical Foundations of Methods.** Study of the application of principles of logic (broadly construed) to methods and curriculum at all levels. Prerequisite: History and Philosophy of Education 301 or equivalent; teaching experience. 1 unit.
408. **Epistemology in Education.** Exploration of knowledge and inquiry as they relate to problems of formulating educational policy, curriculum design, organization of the educational system at all levels, and teaching-learning. Prerequisite: History and Philosophy of Education 301 and 1 unit of epistemology (for example, Philosophy 327, 328, 329, or 330), or equivalent; consent of instructor. 1 unit.
409. **Values and Education.** Study of the nature of value as it relates to problems of formulating and justifying educational aims and policies, curriculum design, organization of the educational system at all levels, and teaching-learning. Prerequisite: History and Philosophy of Education 301 and 1 unit of ethics or value theory, or equivalent; consent of instructor. 1 unit.
410. **Seminar in Theories of Educational and Social Change.** Designed to help prospective educational leaders acquire an understanding of current theories of social change as these relate to educational institutions. There is now an extensive body of knowledge on the nature and control of social change. This needs to be made available to all prospective educational leaders in order that they may go about their duties with greater understanding and skill. Designed to aid students in bringing this knowledge to bear upon the problems of leadership in educational and social change. Prerequisite: History and Philosophy of Education 304 or equivalent. 1 unit.
411. **Philosophy of Educational Research.** Examination of some crucial assumptions and concepts of contemporary research in education from the point of view both of the consumer and the practitioner of educational research. Prerequisite: History and Philosophy of Education 301; a course in the quantitative treatment of educational data, or the equivalent. 1 unit.
412. **Seminar: Dewey's Philosophy of Education.** Critical study of John Dewey's philosophy of education involving intensive study of original works. Prerequisite: History and Philosophy of Education 301 and 308, or equivalent; consent of instructor. 1 unit. May be repeated for credit.
413. **Seminar in Educational Concepts.** Some significant concepts, such as equality, authority, freedom, neutrality, indoctrination, objectivity, and teaching, will be selected and examined in depth. Prerequisite: History and Philosophy of Education 301; an analytic philosophy course, or equivalent; consent of instructor. 1 unit. May be repeated for credit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
483. **Methods in Comparative Education.** Methodologies and concepts involved in comparative educational systems in selected countries; topics related to the role of normative, institutional, and environmental patterns in shaping educational policies related to administration, curriculum development, diversification, and expansion of educational opportunity. Prerequisite: Anthropology 373 or Sociology 300, History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.
484. **Education in the Industrialized Nations.** Examination of educational and national policy in industrialized nations; topics include education and political integration, socialization, economic growth and manpower development, social status and mobility, and educational planning; particular attention given to Western Europe, the USSR,

and North America. Prerequisite: History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.

485. **Education in the Developing Countries.** Analysis of the role and functions of education in social, political, and economic development, with particular reference to the new and the developing countries. Prerequisite: History and Philosophy of Education 303 or 386, or consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in history and philosophy of education; generally open only to persons who have been admitted for doctoral study in history and philosophy of education; sections offered in the following fields: (a) history of education; (b) philosophy of education; (c) comparative education; (d) social foundations of education; (e) philosophy of educational research; and (f) historical methods in education. Prerequisite: For section (c) only, History and Philosophy of Education 483 or consent of instructor; for all other sections, consent of instructor. 1 unit. May be repeated for credit.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student is expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

HISTORY OF ART

(See Art and Design)

HOME ECONOMICS

Director of School: Professor P. C. Paul
School Office: 260 Bevier Hall, Urbana

Effective 3/1/74, the Department of Home Economics will become the School of Human Resources and Family Studies.

105. **Introduction to Human Development.** Systematic overview of the biological, psychological, familial, and cultural factors related to human growth and development throughout the life cycle. 3 hours.
106. **Observation and Analysis of Behavior.** Developmental criteria applied to observation data; inclusion of natural and laboratory settings to give students skill in recording and interpreting human behavior with emphasis on the child. Prerequisite: Credit or concurrent registration in Home Economics 105. 3 hours.
120. **Elementary Nutrition.** Fundamental laws of human nutrition and their application to the selection of an adequate diet. For non-home economics majors. Prerequisite: Sophomore standing. 2 hours.
125. **Food Selection and Preparation.** Elementary study of foods in relation to market selection, preparation methods, and standards; comparative costs and food values; and principles of meal planning. For non-home economics majors. Prerequisite: Sophomore standing. 3 hours.
132. **Foods and Nutrition.** Principles of nutrition and food preparation; experience, through readings, discussion, and laboratory practice, in selection and preparation of foods to

- meet nutritional needs of individuals. Prerequisite: Credit or concurrent registration in Chemistry 101. 3 hours.
133. **Food Management.** Study of factors involved in management of food for the family; food costs and buying; and meal planning and service. Prerequisite: Home Economics 132. 2 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology, Psychology, and Zoology 143. Critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior; topics include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
160. **The Home and Its Furnishings.** Design fundamentals involved in the development and selection of family housing to meet human needs; consideration of the aesthetic, social, economic, and functional aspects of residential environment. 4 hours.
171. **Home Management.** Principles of management related to the resources of the student and of the family; emphasis on the use of time, energy, and money. 2 hours.
182. **Clothing Laboratory: Basic Construction.** Fundamental principles of clothing construction; developmental work with pattern, fabric, and equipment as related to fit, design, fabric, and garment assembly. For students with little or no formal experience in clothing construction. 2 hours.
183. **Consumer Textiles.** Analysis of textile products as a basis for consumer choice. 2 hours.
184. **Apparel Design and Selection.** Theory and practice in applying art principles and symbolism in dress to design and selection of apparel. Prerequisite: Art 185 or consent of instructor. 2 hours.
186. **Clothing Laboratory: Tailoring.** Comparisons of tailoring techniques in the construction of garments; comparison of standard construction and tailoring techniques appropriate to design and fabric. Prerequisite: Home Economics 182, or 4-H, or high school clothing construction course, or consent of instructor. 2 hours.
190. **Freshman Honors Seminar: International Problems as Related to Agriculture.** Same as Agriculture 190. Lectures and discussion dealing with the broad national and international problems of agriculture; explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
192. **Honors Seminar: Science, Food, and World Population.** Same as Agriculture 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival; explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.
194. **Primary Structures in Weaving.** Exploration of basic elements in weaving and related processes; focus on primitive, traditional, and experimental methods of forming cloth. Prerequisite: Art 119 or 185, or equivalent. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours.
202. **Laboratory in Child Development.** Planning for educational experience in various preschool settings and at home; techniques of teaching and guiding the young child derived from developmental and educational research; and direct contact experience with young children in selected environments. Prerequisite: Home Economics 105, and Psychology 100 or Psychology 103. 3 or 4 hours.
203. **Child Development: Period of Infancy and Early Childhood.** Study of the growth and development of young children; their biological and psychological needs and the environmental influences affecting their development and relationships with others; gives an understanding of the developmental sequences and the basic principles of child care and training. Prerequisite: Home Economics 105 or Psychology 216. 4 hours.
210. **Family Relationships.** Same as Anthropology 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; and examination of selected family adjustment problems. 3 hours.

220. **Principles of Nutrition.** Nutritive value of foods and metabolism of essential nutrients; application of principles of nutrition to the requirements of normal individuals throughout the life cycle. Prerequisite: Chemistry 102; Home Economics 132; Physiology 103. 3 hours.
231. **Foods.** Composition and behavior of foods; application of chemistry and other physical sciences to principles of food preparation. Prerequisite: Chemistry 102; Home Economics 133. 3 hours.
240. **Quantity Food Production and Service.** Application of the principles of food preparation and service to institutional and commercial feeding. Credit is not given for both Home Economics 240 and 351. Prerequisite: Food handlers certificate; Economics 108; Home Economics 231; consent of instructor. 2 to 5 hours.
260. **Interiors and Furniture, I.** Development of residential environments from prehistoric to the nineteenth century as seen through the study of architecture and furniture design; consideration of the adaptation and use of period styles in contemporary interiors. Prerequisite: Art 119 or 185, or equivalent. 3 hours.
261. **Interiors and Furniture, II.** Continuation of Home Economics 260. Study of the development of residential environments of the nineteenth and twentieth centuries. Prerequisite: Home Economics 260. 3 hours.
262. **Interior Design.** Designing of interiors and their components; emphasis on design theory, presentation techniques, and evaluation of design concepts. Prerequisite: Home Economics 160 and 261; Art 118, 120, and 123. 3 hours.
263. **Textile Design: Printing.** Creative design developed from historical and traditional background; exploration of various printing techniques, such as block, stencil, and silk screen processes, on fabric; and an analysis of contemporary American design. Prerequisite: Art 120 or 186; consent of instructor. 3 hours.
270. **Family Financial Management.** Application of managerial principles to family finances; consideration of factors affecting the acquisition and use of income, plans for spending and saving during various periods in the family cycle, and the relationship of income to the economic situation. Prerequisite: Economics 102 and 103 or 108; Home Economics 171. 3 hours.
271. **Home Management.** Introduction to home management concepts; application of managerial principles to use of time, energy, and money; and emphasis on consumer goods and services accounting for some major costs of living. For non-home economics majors. 2 hours.
273. **Advanced Home Management.** Seminar course with field experience emphasizing an analytical approach to the study of managerial behavior of families. Prerequisite: Economics 108; Home Economics 171, 210, 220, and 231; Psychology 100 or 103; junior standing in home economics; consent of instructor. 3 hours.
280. **Household Textiles.** Selection of household textiles for consumer use. Prerequisite: Home Economics 183. 2 hours.
281. **Nontextile Apparel and Accessory Materials.** Consumer information about the selection and care of apparel and accessory items of leather, fur, plastic, and metal. Prerequisite: Home Economics 183. 2 hours.
284. **Costume Design.** Creative clothing design using art principles through the media of sketch and color; designing clothing suited to figure type and personality; and understanding the influence of design on contemporary clothing. Prerequisite: Art 120 or 186; Home Economics 184. 2 hours.
285. **History of Costume.** Costumes and their settings from the early Egyptian period through the nineteenth century. 2 hours.
286. **Clothing Design: Flat Pattern.** Designing by drafting patterns using sources of design inspiration appropriate for this process; fitting a basic pattern to use in designing and making a garment. Prerequisite: Art 120 or 186; Home Economics 182 or 186; Home Economics 183 and 184. 3 hours.
287. **Consumer Clothing Problems.** Psychological, sociological, economic, and hygienic as-

- pects of consumer reactions to clothing. Prerequisite: Economics 108; Home Economics 183 or 184; Psychology 100 or 103; Sociology 100. 2 hours.
291. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.
292. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.
294. **Advanced Weaving.** Exploration of traditional and experimental methods of developing fabrics by means of the floor loom. Prerequisite: Home Economics 194. 3 hours.
301. **Advanced Problems in Home Guidance of Children.** Emphasis on the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view toward helping students understand the less obvious and more subtle aspects of child development, and to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. Prerequisite: Home Economics 202 and 203; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **Economics of Consumption.** Same as Economics 313. Analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
320. **Diet in Disease.** Application of the science of nutrition to the maintenance of optimum health and the role of nutrition in the prevention and treatment of disease. Prerequisite: Home Economics 220. 3 hours or $\frac{3}{4}$ unit.
322. **Physical Growth and Nutrition.** Lecture, readings, and discussions. Prerequisite: Home Economics 220; senior standing; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
323. **Recent Advances in Foods and Nutrition.** New developments in foods and nutrition; readings, lectures, and discussions. Prerequisite: Chemistry 102; Home Economics 220 and 231; Physiology 103. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
324. **Problems in Nutrition.** Same as Food Science 324. Discussions and investigations. Prerequisite: Biochemistry 350 and 355, or Biochemistry 354 and 356; Home Economics 220; senior standing. 3 to 5 hours, or $\frac{1}{2}$ or 1 unit.
326. **Presentations: Principles and Techniques.** Selection of problems and organization of materials for demonstrations and other presentations in home economics subject-matter areas. Field trip; estimated cost, \$15.00. Prerequisite: Senior standing; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
330. **Experimental Foods.** Consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. Prerequisite: Home Economics 231; Microbiology 100 and 101. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Problems in Foods.** Individual problems in food preparation and preservation. Prerequisite: Home Economics 330. 3 hours or $\frac{3}{4}$ unit.
345. **Institution and Restaurant Management: Food Purchasing and Equipment Selection.** Purchasing food and selecting equipment for quantity food service; factors affecting the purchase of food; and the relationship of floor plans and equipment to service. Field trip; estimated cost, \$20.00. Credit is not given for both Home Economics 345 and 351. Prerequisite: Credit or concurrent registration in Home Economics 240; Economics 108. 3 hours or $\frac{1}{2}$ unit.
349. **Music in Early Childhood.** Same as Music 349. Detailed consideration of the music program in nursery schools, kindergarten, and the primary grades; topics include the nature of early musical responses, objectives, experience levels of the program, methods of teaching, and materials; and inclusion of observation of music teaching at the Child Development Laboratory. Prerequisite: Senior or graduate level in music education or child development. 2 hours or $\frac{1}{2}$ unit.
350. **Institution and Restaurant Management: Organization and Administration.** Organization and administration of food service operations; management problems in various types of food service: personnel, costs, and sanitary control. Field trips; estimated cost, \$20.00 to \$25.00. Credit is not given for both Home Economics 350 and 351. Prerequisite: Home Economics 220 and 240. 4 hours or 1 unit.

351. **Special Problems in Group Feeding.** For individuals interested in refreshing and strengthening knowledge in group feeding; lectures, discussions, and laboratory practice in quantity food management. Food handlers certificate required. Credit is not given for both Home Economics 351 and Home Economics 240, 345, or 350. Prerequisite: Home Economics 220 and 231, or equivalent; consent of instructor. 3 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
355. **Specialized Quantity Food Production and Management.** Advanced application of food production and management principles to specific food service demands; emphasis on artistry in preparation, serving, and merchandising high quality food in quantity. Prerequisite: Home Economics 240, credit or concurrent registration in Home Economics 350, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
361. **Development and Function of Family Housing.** Same as Agricultural Mechanization 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials, and structure; economic influences, costs, and adaptations; and personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural mechanization students, no prerequisite). 3 hours or $\frac{3}{4}$ unit.
370. **Family Economics.** Same as Agricultural Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
375. **Home Equipment.** Consideration of basic principles related to the selection, use, and care of household equipment; individual problems including an evaluation of sources of information on equipment and equipment performance tests. Prerequisite: Home Economics 171; 6 advanced hours in home economics including one of the following: 231, 273, or 380; senior standing; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
377. **Cooperative Extension: Home Economics.** The philosophy, history, and organization of the cooperative extension service; consideration of program development and methods of presentation and evaluation emphasizing socioeconomic characteristics of state and county. Prerequisite: Economics 108; Psychology 100 and Sociology 100, or Educational Psychology 211, or Agriculture 206; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
378. **Problems in Home Management, Housing, and Interior Design.** Individual investigations and reports of specific problems in the fields of home management, family housing, or interior design. Prerequisite: Home Economics 262 or 270; senior standing; consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
379. **Problems in Family and Consumption Economics.** Individual investigations and reports of specific problems in the field of family and consumption economics. Prerequisite: Economics 102 or 108; a course in applied statistics; Home Economics 313 or 370, or consent of instructor; senior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Advanced Textiles.** Effects of the physical and chemical structures of textile fibers on their properties, manufacturing processes, use, and care. Prerequisite: Home Economics 183; Chemistry 102. 4 hours or 1 unit.
386. **Clothing Design: Draping.** Designing by draping inspired by appropriate design sources; understanding of fitting principles through fabric manipulation; and design effects maintained in garment construction. Prerequisite: Home Economics 285 or consent of instructor; Home Economics 286. 4 hours or 1 unit.
388. **Problems in Textiles and Clothing.** Individual problems in the field of textiles and clothing, retailing of clothing, or weaving. Prerequisite: Home Economics 286, 294, or 380, or Business Administration 212; minimum grade-point average of 3.5; senior standing; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
395. **Fashion Analysis.** Study of fashion terminology, selected designers, garment-manufacturing techniques, and methods of fashion promotion used in retail outlets. Field trip; estimated cost, \$10.00. Prerequisite: Advertising 281 and senior standing, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

- 410. Problems in Family Living.** Family relationships and their significance to the growth of family members. Prerequisite: Home Economics 210. 1 unit.
- 418. Seminar in Child Development.** Advanced problems in child development. Prerequisite: Home Economics 301. 1 unit.
- 419. Seminar in Family Relationships.** Critical evaluation of research literature in the field of marriage and family relationships. Prerequisite: Home Economics 410. 1 unit.
- 422. Seminar in Nutrition.** Study of recent literature in nutrition. Prerequisite: Undergraduate degree in home economics, with emphasis on foods and nutrition, or comparable background in biochemistry, microbiology, physiology, or other biological science. $\frac{1}{2}$ or 1 unit.
- 423. Problems in Human Nutrition.** Methods of assessing nutritional status of humans. Prerequisite: Home Economics 324 or equivalent. $\frac{1}{2}$ or 1 unit. Offered in 1974-75 and in alternate years.
- 432. Seminar in Foods.** Review of current literature in foods research. Prerequisite: Undergraduate major in foods and nutrition, chemistry, microbiology, or physiology; consent of instructor. $\frac{1}{2}$ or 1 unit.
- 457. Sensorimotor Development.** Same as Physical Education 457. Study of the development of spatially adapted movement behavior in man; emphasis on the nature of sensorimotor systems and development of perception; the role of proprioceptive feedback mechanisms and associated reflexes; and the neurogeometric principles basic to the study of man interpreting and acting on his environment. Prerequisite: Physical Education 357, or equivalent. 1 unit.
- 470. Seminar in Family and Consumption Economics.** Same as Agricultural Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 102 or 108, and a course in applied statistics; Home Economics 313 or 370, or consent of instructor. $\frac{1}{2}$ or 1 unit.
- 480. Seminar in Textiles.** Current literature related to development in the production, use, and care of textile fabrics. Prerequisite: Home Economics 380 or equivalent; consent of instructor. $\frac{1}{2}$ or 1 unit.
- 487. Seminar in Clothing.** Study and discussion of research in clothing from the aspects of psychological and sociological factors contributing to the effect of clothing on the development of individuals, and on family and community group reactions. Prerequisite: Undergraduate curriculum with majors in textiles and clothing, home economics education, home economics extension, or general home economics. $\frac{1}{2}$ or 1 unit.
- 493. Advanced Studies in Home Economics.** Library or experimental research on specific problems of limited scope. Work may be taken in the following subjects: (a) child and family; (b) family and consumption economics; (c) family housing; (d) foods; (e) nutrition; and (f) textiles and clothing. May be taken in addition to 8 units required for a master's degree by students who do not write a thesis. $\frac{1}{2}$ or 1 unit.
- 499. Thesis Research.** Work may be taken in the following subjects: (a) child development and family relationships; (b) family and consumption economics; (c) family housing; (d) foods; (e) nutrition; and (f) textiles and clothing. 0 to 4 units.

HORTICULTURE

Head of Department: Professor C. J. Birkeland

Department Office: 124 Mumford Hall, Urbana

- 100. Introductory Horticulture.** Principles and practices involved in the production of fruits, vegetables, and ornamental plants. Lectures and discussions. Prerequisite: Botany 100. 3 hours.

110. **Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Dairy Science 110. Principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours.
122. **Greenhouse Management.** Principles of greenhouse operation, soils, fertilizers, potting, watering, and ventilating. Lectures, reference readings, and greenhouse practice. Prerequisite: Credit or concurrent registration in Botany 100. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
199. **Undergraduate Open Seminar.** 1 to 5 hours.
201. **Identification and Use of Woody Ornamental Plants, I.** Systematic approach to the identification, ornamental characters, culture, propagation, production, and use of woody ornamental deciduous trees and shrubs; special emphasis on the cultivated varieties. Prerequisite: Botany 100 or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
202. **Identification and Use of Woody Ornamental Plants, II.** Systematic approach to the identification, ornamental characters, culture, propagation, production and use of woody ornamental conifers, broadleaf evergreens, vines, ground covers and woody ornamental deciduous trees and shrubs; special emphasis on the cultivated varieties. Prerequisite: Botany 100 and Horticulture 201, or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
210. **Home Grounds Planning and Design.** Practice of developing home grounds; emphasis on analysis and practical solutions of typical site problems; and evaluation of plants and garden structures as elements in home grounds planning and design. Prerequisite: Landscape Architecture 152 or consent of instructor. 4 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
211. **Home Grounds Development and Construction.** Continuation of Horticulture 210, with emphasis on development of home grounds and construction methods and techniques. Prerequisite: Horticulture 210 and Landscape Architecture 152, or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
212. **Landscape Contracting.** Interpretation of the landscape architect's plans and specifications; estimating quantities of materials; and computing costs and procedures for bidding and executing landscape construction. Prerequisite: Horticulture 211; Landscape Architecture 152. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
221. **Plant Propagation.** Principles, methods, and practices employed in the propagation of plants, emphasizing anatomical features and physiological principles involved in sexual propagation (seeds) and asexual propagation (division, cuttings, budding, grafting, etc.). Prerequisite: Botany 100 or equivalent. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
223. **Floricultural Crops Production, I.** Commercial production of major cut-flower crops in the greenhouse and field. Prerequisite: Horticulture 122. 3 hours. Offered in 1975-76 and in alternate years.
224. **Floricultural Crops Production, II.** Commercial production of pot plants and minor greenhouse and field-grown cut flowers. Prerequisite: Horticulture 223. 3 hours. Offered in 1975-76 and in alternate years.
225. **Ornamental Gardening.** Theory and practice of planting and maintaining ornamental plants in public and private landscaped areas; the functional use of ornamental woody

plants, flowers, and turf in the landscape. Not open to students in the ornamental horticulture curriculum. 3 hours.

226. **Bedding and Foliage Plants.** Commercial production and use of tender ornamental plants (grown for outdoor bedding purposes), and of foliage plants (suitable for indoor decorative uses). Prerequisite: Horticulture 122 or Botany 100. 3 hours. Offered in 1974-75 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
230. **Garden Flowers.** The place of herbaceous flowers in the landscape and their cultural requirements and uses; the planning of perennial borders for continuous bloom; and survey of some of the genera contributing importantly to our flower gardens. Of value to nonfloriculture students interested in the home grounds. Prerequisite: Botany 100. 3 hours. Offered in 1974-75 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
231. **Floral Decorations.** Principles of design as applied to the composition and decorative use of flowers, foliage, and accessories. Prerequisite: Junior standing. 3 hours.
232. **Advanced Floral Decorations and Flower Shop Management.** Continuation of Horticulture 231. Flower shop management. Prerequisite: Horticulture 231. 3 hours. Offered in 1974-75 and in alternate years.
233. **Floriculture for the Home.** Fundamentals of home gardening and the effective use of ornamentals as a part of the home environment; subjects include the selection, culture, and use of garden annuals, biennials, perennials, bulbs, and house plants; garden tools and equipment; soil preparation; plant propagation; principles of design and planting methods; garden maintenance; use of fertilizers; pest control; training and pruning; lawn care; hybridizing; growing structures; and care of cut flowers. Not open to students in the ornamental horticulture curriculum. 3 hours.
234. **Nursery Management.** Study of the various practices and methods of operating a commercial nursery for the production of ornamental woody plants used in landscaping. Lectures, assigned reading, and laboratory exercises. Prerequisite: Botany 100. 3 hours. Offered in 1975-76 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
236. **Turf Management.** Principles and practices used in management of the turf grasses in areas of general and special use; of value to students interested in one or more aspects of turf grass utilization. Lectures, assigned readings, and laboratory exercises. Prerequisite: Botany 100. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
242. **Vegetable Crops Production.** Introduction to the growth habits, soil and climatic requirements, culture, storage, varietal characteristics, and pests of vegetable crops. Prerequisite: Horticulture 100 or consent of instructor. 3 hours. Offered in 1975-76 and in alternate years.
251. **Arboriculture.** Principles in the care and maintenance of ornamental trees and shrubs in the established landscape; consideration of environmental factors, soils, nutrition, pruning, tree surgery, and insect and disease control. Prerequisite: Agronomy 101. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
262. **Fruit Science, I.** Technological application of biological principles to the culture of temperate fruit plants. Prerequisite: Botany 100. 3 hours. Offered in 1974-75 and in alternate years.
300. **Special Problems.** Supervised research on individual problems in any phase of horticulture; includes anatomy, breeding, physiology, ecology, or general culture of fruit, vegetable, or ornamental plants. Prerequisite: Not open to students on probation; written

- consent of the instructor and authorized departmental approval required prior to advanced enrollment and registration. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.
307. **International Food Crops.** Same as Plant Pathology 307. Various international food crops studied; production and problems created by diseases and insects emphasized; tropical and subtropical crops stressed; temperate food crops of international importance included; and ecological factors affecting fundamentals of food crop production and plant protection examined. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
321. **Floricultural Physiology.** Study of the physiology and metabolism of floricultural crops during their development from seeds through flowering. Lectures and discussion. Prerequisite: Botany 330 and 335, or equivalent; one semester of organic chemistry. 4 hours or 1 unit.
322. **Plant Nutrition.** Study of the mechanisms of and factors affecting the absorption, transport, and functions of the essential elements required by higher plants. Lectures, discussions, and laboratory. Prerequisite: Agronomy 101; Botany 234 or 330, or consent of instructor. 4 hours or 1 unit.
323. **Principles of Plant Breeding.** Same as Agronomy 323. Genetic and cytological variation in crop plants; the production and control of such variation in developing varieties and hybrids; and the maintenance of high quality seed stocks. Field trips; estimated cost, \$5.00. Prerequisite: Agronomy 110 or equivalent; Botany 100. 4 hours or 1 unit.
333. **Physiology Laboratory.** Same as Agronomy 333 and Botany 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.
335. **Economics of Food Distribution.** Same as Agricultural Economics 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; and (c) consumer demand for food. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
345. **Growth and Development of Horticultural Crops.** Factors affecting growth, development, and quality of horticultural crops, such as photoperiodism, growth regulators, carbon dioxide levels, etc. Lecture and discussion. Prerequisite: One year of general chemistry and one semester of general or plant physiology, or consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Entomology 361 and Zoology 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit.
424. **Mineral Nutrition of Plants.** Same as Agronomy 424 and Botany 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants; the essentiality of various anions and cations in the light of metabolic activity and constituency in functional plant compounds; and major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing

experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Horticulture 340 or equivalent. $\frac{3}{4}$ unit.

447. **Horticulture Seminar.** Discussion of current research and literature pertaining to problems of horticulture and related fields. Prerequisite: Graduate standing in horticulture or related fields. $\frac{1}{4}$ unit.
490. **Research Methods in Horticulture.** Lectures, discussions, demonstrations, and laboratory exercises dealing with methods and apparatus used in horticultural research. Prerequisite: One year of general chemistry and one semester of general or plant physiology, or consent of instructor. 1 unit.
492. **Special Topics in Horticulture.** Readings and discussion in selected phases of horticulture including such topics as genetics, physiology, anatomy, morphology, and ecology of horticultural crops. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and 12 hours for a minor. $\frac{1}{2}$ to 2 units.
498. **The Plant Pigments.** A lecture course offering a comprehensive presentation of the nature, function, distribution, biosynthesis, degradation, separation, and spectroscopic properties of pyrrole, carotenoid, quinone, and anthocyanin pigments. Prerequisite: Botany 330 or consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.
499. **Thesis Research.** Research on problems in floriculture, fruit breeding, pomology, and vegetable crops. Required in horticulture major. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and 12 hours for a minor. 0 to 4 units.

HUMANITIES

Chairman of Division: Professor J. J. Bateman
Division Office: 210 Lincoln Hall, Urbana

114. **Russian Civilization.** Same as Russian 114. Survey of Russian civilization and culture with special emphasis on areas other than literature: the people, national and social institutions, religion, and the arts (architecture, sculpture, painting, music, theatre, ballet). No knowledge of Russian required. 4 hours.
151. **The Humanities in Western Culture.** Comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought; emphasis on history and the novel: for example, Well's Outline of History, Thucydides, Third and Fourth Kings (Knox version), The Odyssey, Don Quixote, and The History of Tom Jones. Prerequisite: Sophomore standing, James Scholar freshman, or freshman standing with exemption from Rhetoric 105. 4 hours.
152. **The Humanities in Western Culture.** Comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought; emphasis on drama, philosophic essay, and poetry: for example, Sophocles, Shakespeare, Plato, Nietzsche, St. Augustine, Ecclesiastes, the New Testament, and Whitman. Prerequisite: Humanities 151. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Ancient Israel: History and Literature.** Same as Religious Studies 201. Major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion; the function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours.
202. **Earliest Christianity: The New Testament Period.** Same as Religious Studies 202. The ministry and teaching of Jesus within the historical context of ancient Judaism; the development of the Christian church from its beginnings as a sect within ancient Judaism

- to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours.
208. **The Dead Sea Scrolls.** Same as Religious Studies 108. The literary works discovered since 1947 which were collected or written by a sect within Judaism near Wadi Qumran prior to the destruction of the Temple of Solomon in the first century of our era; their significance for understanding Judaism and Christianity. Prerequisite: Humanities 201 or 202, or Religious Studies 201 or 202. 3 hours.
 210. **German Literature Since 1648 in English Translation.** Same as German 201. Important trends in German literature since 1648; reading of some important prose works. For students with no knowledge of German. 3 hours.
 211. **The Growth of American Culture, I.** Social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
 212. **The Growth of American Culture, II.** Social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
 215. **Literature and Other Arts, I.** Consideration of literature and other arts in the context of a particular historical period, and in relationship to the movement of ideas within that period. Prerequisite: Junior standing or consent of instructor. 3 hours.
 216. **Literature and Other Arts, II.** Continuation of Humanities 215. Prerequisite: Humanities 215. 3 hours.
 255. **Introduction to French Literature in Translation, I.** Same as French 255. Study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures in English; not open to students majoring in French. 4 hours.
 256. **Introduction to French Literature in Translation, II.** Same as French 256. Study of selected major works of French literature from the romantic period to the present. Texts and lectures in English; not open to students majoring in French. 4 hours.
 315. **Nineteenth-Century Russian Literature in Translation.** Same as Russian 315. Study of major Russian writers from Pushkin through Chekhov. No knowledge of Russian required. 3 hours or 1 unit.
 317. **Twentieth-Century Russian Literature in Translation.** Same as Russian 317. Study of major Russian writers from 1900 to the present. No knowledge of Russian required. 3 hours or 1 unit.
 319. **Russian and East European Cinema.** Same as Communications, Slavic, and Speech 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian required except for Department of Slavic Languages and Literatures majors. 3 hours or $\frac{3}{4}$ unit.
 361. **Ibsen.** Same as Scandinavian 361. The dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit. Offered in 1975-76 and in alternate years.
 362. **Strindberg and the Later Scandinavian Dramatists.** Same as Scandinavian 362. Major dramas and prose works of August Strindberg in translation; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Par Lagerkvist. 3 hours or 1 unit. Offered in 1974-75 and in alternate years.
 363. **Introduction to Comparative Literature, I.** Same as Comparative Literature 363. One year course in two parts, offering a survey of methods and goals of comparative literature, illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or $\frac{3}{4}$ unit.
 364. **Introduction to Comparative Literature, II.** Same as Comparative Literature 364. Continuation of Humanities 363. 3 hours or $\frac{3}{4}$ unit.

INDUSTRIAL ENGINEERING

(See Mechanical and Industrial Engineering)

ITALIAN

(See Spanish, Italian, and Portuguese)

JAPANESE

(See Asian Studies)

JOURNALISM

Head of Department: Professor J. W. Jensen

Department Office: 119 Gregory Hall, Urbana

114. **Agricultural Communications Media and Methods.** Same as Agricultural Communications 114. Introduction to print, broadcast, visual, and other major communications media used to convey agricultural information; development of basic skills in communicating through those media. Prerequisite: Completion of campus rhetoric requirement. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
204. **Typography.** Study of type lore and design; type dimensions; printer's arithmetic and copyfitting; platemaking; printing processes; shop organization; and terminology. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
211. **News writing.** Fundamentals of journalistic writing. News-editorial majors do not receive credit for this course. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
212. **Public Affairs Reporting.** News of public affairs. News-editorial majors do not receive credit for this course. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 3 hours.
214. **Agricultural Communications Strategy.** Same as Agricultural Communications 214. Coordinated approach to planning and carrying out programs of agricultural information and education using a variety of communications media. Students apply principles of strategy to actual communications problems of their choice. Prerequisite: Agricultural Communications 114 or consent of instructor. 3 hours.
215. **Contemporary Affairs.** Major news developments and their background; current political, economic, social, and scientific developments. Prerequisite: Journalism 212 or 350; registration in the College of Communications or consent of the college. 2 hours.
217. **History of Communications.** Same as Communications 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; and communications in the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
218. **Communications and Public Opinion.** Same as Communications 218. Theory of public opinion and of communications; relation of communication systems to public opinion.

- ion, social systems, and the political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
220. **Processes and Systems of Communications.** Same as Communications 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
223. **Photojournalism.** A basic photography course designed to give the student a proficiency in picture taking and processing and to acquaint him with picture editing and other illustrative problems. Cost of materials approximately \$15.00 per student; cameras provided by the college. Prerequisite: Registration in the College of Communications; consent of instructor. 3 hours.
231. **Mass Communication in a Democratic Society.** Same as Communications 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
233. **Publication Design and Production.** Theory of publication design; techniques of graphic production; and relationship of design and graphics to the realities of commercial printing. Prerequisite: Journalism 204 or consent of instructor. 2 hours.
241. **Law and Communications.** Same as Communications 241. Historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications 251 and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in journalism for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 1 or 3 hours.
308. **High School Journalism.** Journalistic writing in the high school; newspaper study and training of newspaper readers; supervision of school publications and publicity; and junior college courses in journalism. Prerequisite: Consent of instructor. 3 hours or ½ unit.
310. **Typographic Disciplines of the Book.** Same as Library Science 310. Study of the book as a manufactured object; emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration and extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or ½ unit.
321. **Editing.** Newspaper desk work; editing the news; correction of faulty news stories; handling wire copy; and attention to headwriting, news pictures, and makeup and design of newspaper pages. Prerequisite: Credit or concurrent registration in Journalism 204 and 212; registration in the College of Communications or consent of the college. News-editorial majors do not receive credit for this course. 3 hours, or ½ to 1 unit.
326. **Magazine Article Writing.** Preparation of feature stories and articles; techniques of marketing, market analysis, and publishing articles written in the course. Prerequisite: Journalism 211 or 350; registration in the College of Communications or consent of the college. 3 hours or ½ unit.
329. **The Rhetoric of Journalism.** Studies in journalistic method involving principally the analysis of structure and writing style as related to purpose; materials drawn from English and American journalism from the seventeenth century to the present; and emphasis on work published in twentieth-century American newspapers and periodicals. Prerequisite: Journalism 211 or 350, or consent of instructor. 2 hours or ½ unit.
330. **Magazine Editing.** Basic principles of editing for consumer, business, trade, and company magazines; communications theory, market analysis, editorial process, design

process, production process, and distribution process as they relate to magazine publishing. Prerequisite: Credit or registration in Journalism 326 or consent of instructor. 3 hours or ½ unit.

350. **Journalism, I.** Fundamentals of journalistic writing; reporting news of public affairs. Prerequisite: Enrollment as a major in the Department of Journalism or consent of department. 4 hours or 1 unit.
360. **Journalism, II.** Rational and aesthetic standards of visual communications; principles and techniques of making visual statements; and uses of visual technology in wedding verbal and nonverbal languages. Prerequisite: Enrollment as a major in the Department of Journalism or consent of department. 4 hours or 1 unit.
370. **Journalism, III.** Developing a journalistic depth report; writing a depth report with a view to its final visual and graphic form; and conceptually editing the material of the depth report. Prerequisite: Journalism 350 and 360; enrollment as a major in the Department of Journalism or consent of the department. 3 hours, or ½ to 1 unit.
380. **Journalism, IV.** Planning, researching, writing, and editing of depth reports; packaging depth reportage and reproducing for publication as a professional and public service. Prerequisite: Journalism 350 and 360; enrollment as a major in the Department of Journalism or consent of the department. 3 hours, or ½ to 1 unit.
468. **The Political Economy of Communications.** Same as Communications 468. Analysis of the structure, policy, and behavior of such media of communication as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film; special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
470. **Communications and Popular Culture.** Same as Communications 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
471. **Proseminar in Communications, I.** Same as Communications 471. General discussion of the mass media of communications, their role as social institutions, and their control and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
472. **Proseminar in Communications, II.** Same as Communications 472. General discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
473. **History and Theory of Freedom of the Press.** Same as Communications 473. Development of the Anglo-American press system and the idea of freedom of the press; contemporary mass media and their implications for freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
474. **Communications Systems.** Same as Communications 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. Prerequisite: Consent of College of Communications. 1 unit.
490. **Special Topics in Journalism.** Prerequisite: Consent of head of department. ½ or 1 unit.
492. **Research Methods in Communications.** Same as Communications 492. Introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication; emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in journalism. 1 to 2 units.

KOREAN

(See Asian Studies)

LABOR AND INDUSTRIAL RELATIONS

Director of Institute: Professor M. Rothbaum

Institute Office: 247 Labor and Industrial Relations Building, Champaign

199. **Undergraduate Open Seminar.** 0 to 9 hours.
315. **The Economics of Poverty and Income Maintenance.** Same as Economics 315. Economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Industry and Society.** Same as Sociology 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; and the changing bases of managerial authority. Prerequisite: Sociology 100 or 6 hours of social science, or consent of instructor; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Industrial Social Systems, I.** Same as Business Administration 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environments; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210; Psychology 100; Psychology 201 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
341. **The Economics of Labor Markets.** Same as Economics 341. Study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems; topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; and employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **Unions, Bargaining, and Public Policy.** Same as Economics 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States, including theory of the labor movement; processes of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; and problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Economics of Manpower.** Same as Economics 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; and private industry and union manpower planning. Graduate credit is not given for both Labor and Industrial Relations 345 and 344 and/or Economics 345 and 444. Prerequisite: Economics 103 or 108. 3 hours, or $\frac{1}{2}$ or 1 unit.
347. **Labor Law, I.** Same as Law 347. The law of industrial relations with special emphasis on recent cases and legislation; the establishment of the collective bargaining relationships; strikes, boycotts, and picketing; and federalism and labor relations. 3 hours or 1 unit.
355. **Industrial Social Psychology.** Same as Psychology 355. Social psychological research and theory applied to industrial problems; emphasis on interaction and communica-

tion theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as aids in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or $\frac{1}{2}$ or 1 unit.

357. **Psychology of Industrial Conflict.** Same as Psychology 357. Analysis of the causes and possible solutions of industrial conflict in terms of the behavior of individuals. Offered for industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
360. **Employee Benefit Plans.** Same as Finance 360. Analysis of the economic and financial issues involved in designing and administering employee benefit plans; major emphasis on group life, disability income, and medical care plans, and on qualified pensions and profit-sharing plans for regular employees; and some attention to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Industrial Administration 351, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
418. **Seminar in Industrial and Economic Sociology.** Same as Sociology 418. Discussion and individual research on such topics as industrialization, labor-management relations as group relations, the interrelations of industry and community, technology and the structure of controls in industry, and the problem of a social economics. Prerequisite: Labor and Industrial Relations 318 or consent of instructor. 1 unit.
420. **Formation of Public Policy.** Same as Political Science 420. Examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, and judicial activity. 1 unit.
435. **Motivation and Morale in Industry.** Same as Psychology 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; and modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
440. **Labor Economics.** Same as Economics 440. Survey of recent trends in the labor force, of real and money earnings, and of the distribution of national income; review of recent trends in these areas used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.
441. **Labor Economics.** Same as Economics 441. Economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free enterprise economy); emphasis in all cases on the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
442. **Collective Bargaining.** Same as Economics 442. Development of a theory of the continuing interactions between union and management which define and modify the role of each and the terms of employment; use of appropriate social science concepts; and emphasis on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority, and on the interactions between the parties and the governmental process. Graduate credit is not given for both Economics 343 and Economics 442 or Labor and Industrial Relations 442. Prerequisite: Consent of instructor. 1 unit.
443. **Problems and Practices of Labor Dispute Settlement.** Same as Economics 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling; analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit.
444. **Economics of Manpower Resources.** Same as Economics 444. Emergence of the manpower resource issue; population as a resource base; the labor force: measurement and characteristics, behavior under changing income, employment, and technology; women as the dynamic factor in labor force growth; problems of utilization of labor force components: intellectual resources, older workers, and manual, white collar, Negro, and marginal forces; and issues of national manpower policy. Graduate credit is not given

- for both Labor and Industrial Relations 444 and 335. Prerequisite: Consent of instructor. 1 unit.
445. **Investment in Human Resources.** Same as Vocational and Technical Education 445. Activities which influence future monetary and psychic income by improving the resources in people; coverage of investments, including schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes; main emphasis on education; and a last section covering educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.
447. **Labor Union Organization and Administration.** Same as Economics 447. Analysis of the structure, functions, and government of the modern American trade union movement; survey of the environmental factors, objectives, and action programs with considerable emphasis on economic and internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit.
448. **Problems of Personnel Management.** Same as Business Administration 448. Examination of the organization and administration of the personnel function in management; the relations of personnel administration to operating departments, and the scope of business and industrial personnel services; and an analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, carried out through case studies and direct industrial contacts. Specific consideration is given to problems up to and including placing the person on a job. Prerequisite: Business Administration 248 or equivalent; consent of instructor. 1 unit.
450. **Management and Industrial Relations.** An analysis of the industrial relations function in management. Using case problems, research reports, and theoretical analyses, an examination is made of the development of the industrial relations function, alternate organizational approaches in dealing with employees and unions, the formation of labor relations policies, and management responsibilities in industrial relations. Prerequisite: Consent of instructor. 1 unit.
451. **Labor Law and Public Policy.** Same as Law 371. Analysis of current major policy issues in labor law and administration through the concepts and techniques of the lawyer and the labor relations specialist. Prerequisite: For law students, Law 347 or consent of instructor; for Institute of Labor and Industrial Relations and other graduate students, one semester of labor and industrial relations course work or consent of instructor. 2 hours or 1 unit.
454. **Foreign and International Labor Movements.** History and organization, economic and political policies of the major labor movements in the world; their international organizations; comparative analysis of particular problems confronting these movements; labor movements in underdeveloped areas; labor and economic development; and labor under totalitarian regimes. Prerequisite: Consent of instructor. 1 unit.
455. **Labor in Less Developed Countries.** The labor problem in economic development; the development of institutions and systems of industrial relations. Prerequisite: Consent of instructor. 1 unit.
456. **Industrial Relations Theory, I.** An integrated analysis of the principles of labor relations through the study of the works of the major theorists and their critics. Prerequisite: Consent of instructor. 1 unit.
457. **Industrial Relations Theory, II.** An integrated analysis of the principles of labor relations through the study of the works of the major theorists and their critics. Prerequisite: Labor and Industrial Relations 456. 1 unit.
458. **Faculty-Student Workshop.** Training and experience for Ph.D. students in the application of social science and industrial relations theory and research methodology to contemporary industrial relations problems through presentation and discussion of faculty and student research. Ph.D. students are required to give at least one paper, lecture, or other acceptable workshop presentation and to participate in workshop discussions during the entire period of their campus residency for a total of 1 unit of credit. Prerequisite: Labor and Industrial Relations 456 and 457. 0 to 1 unit.

- 490. Individual Topics.** A student in labor and industrial relations may register for this unit with the consent of his curriculum adviser and the adviser under whom he will perform individual study or research. Such individual work may include special study in a subject matter for which no course is available or an individual research project, including on-the-job research in industry, which is not being undertaken for a thesis. 0 to 2 units.
- 491. Research Workshop.** A seminar in applied group research. A general topic for research is assigned; the class adopts a general strategy or approach to the problem; and individual students select a particular aspect of the problem to investigate. Designed as a sequel to Labor and Industrial Relations 492 to give students experience in joint research on practical problems in industrial relations of the type they might expect to work on in business, government, or unions. This seminar or the tutorial is required of all M.A. candidates in the B program sequence. Prerequisite: Labor and Industrial Relations 492. 1 unit.
- 492. Research Seminar in Labor and Industrial Relations.** Systematic analysis of theories and procedures of the various social and physical sciences bearing on research in labor and industrial relations; primary emphasis on the process of integrating the approaches and techniques of the various social sciences with respect to the study of problems in labor and industrial relations as met in practice in management, the union, and government service, as well as in teaching and research in the field. Prerequisite: Major in social sciences or consent of instructor. 1 unit.
- 493. Quantitative Methods in Labor and Industrial Relations.** Introduction to statistical concepts and methods in the social sciences and their application to industrial relations problems; familiarizes the student with modern methods of probability sampling, statistical inference, and multivariate analysis, and their application to current research problems in labor and industrial relations. Prerequisite: Any elementary statistics course, such as Economics 170. 1 unit.
- 496. The Evolution of Labor-Management Relations in America.** Analysis and interpretation of the development of labor-management relations at the plant and industry levels from the stages of master and servant and master and journeyman in colonial times to the stage of constitutional government and industrial democracy in the present day. Prerequisite: Graduate standing in labor and industrial relations or consent of instructor. 1 unit.
- 497. Collective Bargaining in Public Employment.** Same as Social Work 497, Educational Administration 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
- 498. Analysis of Organizations in Industrial Relations.** Intensive analysis of organizational behavior, with the main focus upon the theory of organizations as social institutions; concepts drawn from the various social sciences and applied to the principal organizations concerned with industrial relations; and examination of the internal dynamics of unions, managements, and government agencies, with special reference to decision-making processes, and their individual relations to the interactions among them. Prerequisite: Consent of instructor. 1 unit.
- 499. Thesis Research.** For all students writing theses in labor and industrial relations. 0 to 4 units.

LANDSCAPE ARCHITECTURE

Head of Department: Professor R. B. Riley

Department Office: 205 Mumford Hall, Urbana

101. **Introduction to Landscape Architecture.** Survey of the profession, practice, and philosophy of landscape architecture. 2 hours.
102. **Site Planning.** Principles and procedures of site analysis, land-use determination, and landscape development. 2 hours.
122. **Landscape Surveys.** Principles and practices of identifying, analyzing, and recording landscape resources. Field trip required; estimated cost, \$20.00. 3 hours.
133. **Landscape Design.** Basic elements and procedures of landscape design; principles of landscape composition and the communication of ideas. 4 hours.
134. **Site Design.** Principles of site planning; orientation, circulation, and land-use definitions applied in typical landscape development situations. Prerequisite: Landscape Architecture 133 or consent of instructor. 4 hours.
141. **Landform Design.** Introduction to the basic elements, principles, and methods of grading and surface drainage. 3 hours.
151. **Plant Materials, I.** Identification, ecology, and uses of woody and herbaceous plants: deciduous trees, shrubs, and ground covers; annuals, perennials, and grasses. Field trip required. Prerequisite: Biology 100, Botany 100, or Geography 103, or consent of instructor. 3 hours.
152. **Plant Materials, II.** Identification, ecology, and uses of plant types: woody evergreen trees, shrubs, and ground covers; herbaceous wild flowers, bulbs, and aquatic plants. Field trip required. Prerequisite: Biology 100, Botany 100, or Geography 103, or consent of instructor. 3 hours.
181. **Visual Communications, I.** Principles and techniques of graphic presentation of landscape architecture projects. Prerequisite: Architecture 171 and 172. 2 hours.
182. **Visual Communications, II.** Continuation of Landscape Architecture 181; emphasis on three-dimensional and other nongraphic means of visual presentation. Prerequisite: Landscape Architecture 181. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Field Trip.** Field trip to urban areas to observe and examine examples of landscape architecture, architecture, and planning; includes visits to private and public professional offices. Fee of approximately \$50.00 required for traveling expenses. Prerequisite: Sophomore or junior standing in landscape architecture or consent of instructor. 0 credit.
213. **People, Land, and Environment.** Nontechnical study of the landscape and the environment as products of a natural base worked upon by people, their technologies, and their beliefs; approach is both historical (from prehistory to science fiction) and problem oriented (the use of land, resources, and energy). 2 to 4 hours.
214. **History of Landscape Architecture.** Analysis of the development of landscape design as a result of environmental and cultural influences. 3 hours.
226. **Principles of Park Design.** Introduction to the theory of master planning and site design as related to recreation area development, administration, and operations. 2 hours.
235. **Recreation Land Design.** Techniques of analysis, design, and presentation applied to various recreational land development situations. Prerequisite: Landscape Architecture 134 or consent of instructor. 4 hours.
236. **Urban Land Design.** Techniques of analysis, design, and presentation applied to various residential land development situations. Prerequisite: Landscape Architecture 235 or consent of instructor. 4 hours.
243. **Site Engineering.** Principles of design and layout of circulation and utility systems. Prerequisite: Landscape Architecture 102 and 141. 3 hours.
244. **Landscape Construction.** Materials and methods of construction applied to the design

of landscape structures. Prerequisite: Landscape Architecture 102 or consent of instructor. 3 hours.

246. **Professional Practice.** Professional responsibilities of the landscape architect; methods of practice; and preparation and execution of contracts and specifications. Prerequisite: Senior standing in landscape architecture or consent of instructor. 3 hours.
253. **Planting Design, I.** Applied plant ecology related to the process of landscape planning and design. Prerequisite: Landscape Architecture 151 or 152. 3 hours.
254. **Planting Design, II.** Selection and arrangement of plant materials for aesthetic and utilitarian purposes. Prerequisite: Landscape Architecture 151 or 152. 3 hours.
337. **Regional Landscape Design.** Advanced problems of landscape design for urban and institutional situations. Prerequisite: Landscape Architecture 236 or consent of instructor. 5 hours, or 1 to 1 1/2 units.
338. **Thesis Design Project.** Terminal project; comprehensive landscape architectural development. Prerequisite: Landscape Architecture 337 or consent of instructor. 5 hours, or 1 to 2 units.
370. **Design-Behavior Interaction.** Critical discussion of notions and theories pertaining to the reciprocal effects of landscape architectural design and human behavior. 2 hours or 1/2 unit.
435. **Urban Design.** Design development of new or renewed urban areas and systems in collaboration with architecture and urban planning students. Prerequisite: Passage of special design examination; credit or concurrent registration in Urban Planning 384. 2 units.
436. **Advanced Landscape Design.** Comprehensive master planning and site design for large public, semipublic, and private properties; encouragement of special problems in collaboration with students from other disciplines. Prerequisite: Passage of special design examination or consent of instructor. 1 unit.
437. **Regional Landscape Design.** Detailed investigation of landscape resources and characteristics of large geographical areas; determination of land-use design proposals. Prerequisite: Consent of instructor. 1 unit.
447. **Advanced Landscape Construction.** Advanced investigations and applications of new techniques of construction to landscape development. Prerequisite: Landscape Architecture 243 and 244, bachelor's degree in landscape architecture, or consent of instructor. 1/2 or 1 unit.
457. **Landscape Management.** Investigation of management theories, policies, and practices which influence landscape preservation and development; emphasis on their cumulative effects upon natural processes and aesthetic qualities. Prerequisite: Consent of instructor. 1 unit.
471. **Design-Behavior Fieldwork.** Preparation and application of field strategies to identify and to analyze behavioral trends as they relate to the physical environment; emphasis on user behavior in parks and playgrounds. Prerequisite: Landscape Architecture 370 recommended. 1 unit.
487. **Seminar.** Preparation, presentation, and discussion of research papers on current and future areas of landscape architectural application. Prerequisite: Consent of instructor. 1/2 unit.
490. **Special Problems.** Nature and scope of projects to be determined by consultation between student and faculty adviser; open to landscape architecture majors as well as those from other disciplines who wish to engage in interdisciplinary work. Prerequisite: Consent of instructor. 1/2 to 2 units.
499. **Thesis Research.** Prerequisite: Graduate standing in landscape architecture. 0 to 2 units.

LATIN

(See Classics)

LATIN AMERICAN AND CARIBBEAN STUDIES

Director of Center: Professor M. H. Forster

Center Office: Room 250, 1208 West California Avenue, Urbana

195. **Freshman Seminar.** An intensive review of domestic and foreign factors influencing violence and social change in Latin America. Each semester a particular topic is selected. Prerequisite: Freshman James Scholar or other designation as a superior student. 3 hours.
201. **Conflict in Latin America.** A topical survey of social, economic, and political factors influencing conflict and violence in Latin American life. Each semester a particular topic is considered. Prerequisite: A basic course in a social science discipline. 3 hours.

LAW

Dean of College: Professor E. J. Cribbet

College Office: 209 Law Building, Champaign

Information on professional courses which may be taken for credit by L.L.M., M.C.L., and J.S.D. candidates may be obtained from the college office.

499. **Thesis Research.** 0 to 3 units.

LIBERAL ARTS AND SCIENCES

Program Administrator: Professor R. K. Applebee

Program Office: 294 Lincoln Hall, Urbana

110. **Workshop-tutorial.** A workshop-tutorial in special topics for students in the experimental living learning unit, Unit One only; topics and hours to be arranged. Prerequisite: Permission of the director of Unit One. 1 to 6 hours.
140. **Thought and Structure in Physical Science.** An approach to the structure of scientific theories using some of the subject matter of descriptive astronomy and physics; emphasis on the nature of scientific thinking and the criteria for the validity of scientific ideas. Lecture, laboratory, and discussion. 4 hours.
141. **The Physical Universe.** Study of the various forms of universal energy, using some of the subject matter of cosmology and modern physics; emphasis on such items as man's ability to measure very far distances and to interpret the evidence for the origin of the solar system and of the universe. Prerequisite: Liberal Arts and Sciences 140. 4 hours.
142. **Earth Evolution and Chemical Environments.** Same as Geology 142. A physical science course for nonscience majors; a general discussion of the origin and evolution of the earth, its continents and ocean basins, and basic chemical aspects of the earth's eco-

logic systems, including water and air pollution, radiation chemistry, and the use of pesticides in nature. 4 hours.

143. **Environmental Physical Science.** Same as Geology 143. A physical science course for nonscience majors with emphasis on earth processes and resources relevant to modern society; an attempt to place in perspective the physical limitations imposed by earth through discussion of the physical nature of the environment, the basic principles that apply within pollutant levels, and conditions for a stable environment. 4 hours.
197. **Freshman Seminar in Physical Science.** A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Galileo to Faraday have supported new scientific concepts and theories; discussion, individual research, and reports; and laboratory work replicating significant experiments. Prerequisite: James Scholar or designation as a superior student; consent of instructor. 4 hours.
198. **Freshman Seminar in Physical Science.** A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Maxwell to modern times have supported new scientific concepts and theories; discussion, individual research, and reports; and laboratory work replicating significant experiments. Prerequisite: Liberal Arts and Sciences 197. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
210. **Experimental Seminar.** Seminar or workshop in special topics for Unit One students only; topics to be arranged in areas not treated by regular course offerings, or in areas within the expertise of the Unit One staff. Credit toward college or departmental requirements is contingent on approval of the appropriate unit. Prerequisite: Consent of instructor and sophomore standing. 3 hours.
299. **LAS Study Abroad.** Provides campus credit for foreign study. A student's proposal for study abroad must have prior approval of the major department and the College of Liberal Arts and Sciences office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Permission of the student's major department and the College of Liberal Arts and Sciences office. 0 to 15 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 30 semester hours per academic year or to a total of 36 semester hours, all of which must be earned within one calendar year.

LIBRARY SCIENCE

Director of Graduate School: Professor H. Goldhor
School Office: 329 Library, Urbana

195. **Introduction to Library Use.** Use of the card catalog, periodical indexes, encyclopedias, dictionaries, and other reference books. Intended for freshman and sophomores; not to be counted toward the undergraduate minor in library science. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Reference Service:** A basic course on the most commonly used reference sources; stresses the study of the various types of reference tools, such as dictionaries, encyclopedias, printed indexes, biographical dictionaries, yearbooks, directories, and handbooks; and emphasizes methods of studying such materials and matters of bibliographical form in order to lay a foundation for succeeding courses in the field. Prerequisite: Sixty hours of academic work. 3 hours.
204. **Development and Operation of Libraries.** Introduction to the development of the library as an institution, the concept of a philosophy of librarianship, and the general operation of libraries. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours).

255. **Organization of Library Materials.** Introduction to the function and form of the modern library catalog and to present-day practices in the cataloging and classification of books and audio-visual materials, as practiced in modern libraries. Prerequisite: Junior standing (60 hours of academic work). 3 hours.
258. **Selection of Library Materials.** The philosophy and practice of building the library collection; develops familiarity with book trade channels, especially those in the United States, and acquaints students with the aids useful in selecting and acquiring books, periodicals, documents, and other print and nonprint materials. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours).
301. **Literature of the Humanities and Social Sciences.** Builds a knowledge of the scope and significant characteristics of the several fields comprising the humanities and social sciences through a systematic study of names, trends, and outstanding classic and current materials in each; identifies general basic knowledge for each field which is essential for the librarian in selection of materials and reading guidance. Prerequisite: Consent of instructor. 3 hours or 1 unit.
302. **Literature of the Sciences.** Introduction to the scope, development, and characteristics of the literature of science and technology, and to typical works in pure and applied science; designed to give insight into the content of the scientific disciplines and of their role in modern society. Prerequisite: Consent of instructor. 3 hours or 1 unit.
303. **Library Materials for Children.** The selection and use of library materials for children in public and school libraries, according to the needs of the child in his physical, mental, social, and emotional development and the purposes of the elementary school program. The student becomes acquainted with the standard book selection aids for children and with all types of printed and audio-visual materials and develops the ability to select and describe children's library materials according to their developmental uses. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
304. **Library Materials for Young Adults.** Selection and use of library materials for the young adults in school and public libraries and community organizations; aims to develop the ability to select and evaluate a wide variety of reading materials from standard bibliographies for the young adult according to his personal and school needs. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **Audio-visual Services in Libraries.** Designed to acquaint student with the typical audio-visual programs and responsibilities of libraries; stresses, through group activities of presentation and evaluation, the use of materials and related equipment necessary for film, radio and television, exhibit, and other programs of libraries; and reviews and evaluates the practices of audio-visual departments in libraries. Prerequisite: Consent of instructor. 3 hours or 1 unit.
309. **Storytelling.** Fundamental principles of the art of storytelling including techniques of adaptation and presentation; content and sources of materials; story cycles; methods of learning; practice in storytelling; and planning the story hour for the school and public libraries, for recreational centers, for the radio, and for television. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Typographic Disciplines of the Book.** Same as Journalism 310. The study of the book as a manufactured object; emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration; and extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or $\frac{1}{2}$ unit.
354. **Audio-Visual Communication.** Same as Elementary Education 354 and Secondary Education 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
400. **Foundations of Librarianship.** Introduction to the conceptual framework of librarian-

ship; the relationship of library services (collection building, collection organization, and dissemination of information and materials) to the community. 2 units.

402. **Studies of Research in Reading.** Designed to acquaint students with the major areas of research in the fields of reading; special attention given to studies of the interests and reading habits of children, youth, and adults, and their implications for library science. 1 unit.
405. **Library Administration.** Designed to supply knowledge of the internal organization of libraries and of the principles of library administration; emphasis on comparison of the conditions found in the several kinds of libraries and on applications of the general theory of administration. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
406. **Media Programs and Service for Children and Young Adults.** The role, problems, and needs of children's and young adults' library services in the school and public library. A two-day field trip required; estimated expense, \$35.00. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
407. **Cataloging and Classification, I.** Theory, practice, and application of the principles of cataloging and classification; emphasis on subject cataloging and complex types of entry; and problems providing experience with the Decimal classification, Library of Congress classification, and the Library of Congress subject headings. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
408. **Cataloging and Classification, II.** Theory, practice, and application of the principles of cataloging and classification; cataloging and classification of special types of materials, including maps, music, films, slides, phonograph records, and incunabula and other rare items; and some discussion of the administrative problems of a cataloging department. Prerequisite: Library Science 407. 1 unit.
409. **Communication Roles and Responsibilities of Libraries.** Consideration of mass media of communication in terms of their relations with modern library services; review of media organization, content, and research; consideration of problems of intellectual freedom as an aspect of communications behavior; and discussion of the potential role of electronic devices in library activities now and for the future. 1 unit.
410. **Adult Public Services.** The literature, history, and problems of providing library service to the general adult user; investigation of user characteristics and needs, and the effectiveness of various types of adult services. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
411. **Reference Service in the Humanities and Social Sciences.** Detailed consideration of the bibliographical and reference materials in various subject fields; training and practice in their use for solving questions arising in reference service. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
412. **Science Reference Service.** Study of representative reference sources and of information needs of readers in pure and applied science; designed to acquaint the student with problems encountered in providing reference and research service in these fields. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
415. **Library Automation.** Introduction to various types of equipment for handling information and providing services in libraries; study of applications to library operations; and introduction to systems planning, to automation concepts, and to computer use. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
424. **Government Publications.** The nature and scope of American and British government publications; the organizational problems arising from their form and from the methods of their production and distribution. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
427. **Resources of American Research Libraries.** Acquaints students with the distribution and extent of American library resources for advanced study and research; spatial and financial aspects of library resources; methods of surveying library facilities; growth and use of union catalogs and bibliographical centers; interinstitutional agreements for specialization of collections and other forms of library cooperation; and the use of the

- research collection by the scientist and scholar. Prerequisite: Library Science 400 or consent of instructor; 1 unit.
428. **Library Buildings.** Study of the library's physical plant in the light of changing concepts and patterns of library service; analysis of present-day library buildings, (both new and remodeled) and their comparison with each other as well as with buildings of the past; examination of the interrelationship of staff collections, users, and physical plant; and discussion supplemented by visits to new libraries and conference with their staffs. A two-day field trip is required; estimated cost, \$35.00. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
429. **Information Storage and Retrieval.** Analysis of the problems which confront libraries and library users as a result of the growth of literature; review of the various systems for storing and retrieving information; introduction to the underlying models and basic types of equipment for both traditional and nonconventional systems; and emphasis on practical applications in libraries and information centers. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
430. **Advanced Reference.** Enables the student to utilize the varied resources of a large research library; deals with the methods of analyzing and solving bibliographic problems such as arise in scholarly libraries and in connection with research projects. Prerequisite: Library Science 411 or 412, or consent of instructor. 1 unit.
431. **Books and Libraries in the Ancient and Medieval World.** The development of writing and of the book in ancient and medieval times; book collecting and the growth of libraries from earliest times to the discovery of printing. 1 unit.
432. **Books and Libraries Since the Renaissance.** Same as Communications 432. Study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
433. **Advanced Subject Bibliography.** Study of the literature, information sources, and reference aids in various specialized fields of knowledge, identified as different sections of this course, from the point of view of their use by librarians. Prerequisite: Consent of instructor. ½ unit. May be repeated for a total of 1 unit.
434. **Library Systems.** Development of library systems, with special reference to public libraries as a norm for the development of library services; detailed treatment of library standards, the growth and development of county and regional libraries, and the role of the state library and of federal legislation. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
438. **Administration and Use of Archival Materials.** Administration of archives and historical manuscripts; emphasis on the processing and research use of archival materials. Prerequisite: Consent of instructor. 1 unit.
439. **Medical Literature and Reference Work.** Consideration of representative reference and bibliographical aids in medical sciences; problems provide experience with typical medical reference sources (only at the University of Illinois Medical Center in Chicago). Prerequisite: Consent of instructor. 1 unit. Offered in the summer session only.
440. **Problems in Bibliographical Method.** Same as English 489. 1 unit.
441. **History of Children's Literature.** Interpretation of children's literature from the earliest times to the present, with recognition given to the impact of the changing social and cultural patterns on books for children and on children's reading; attention to early printers and publishers of children's books and to magazines for children in the nineteenth century. 1 unit.
442. **Seminar in Library Materials for Children and Young Adults.** Advanced study of the criteria for the evaluation of books, films, and recordings. Each student completes a project on a given theme or subject involving extensive and critical reading, viewing, and listening. Prerequisite: Library Science 303 or 304, or consent of instructor. 1 unit.
443. **Contemporary Book Publishing.** Survey of twentieth-century book publishing, particularly in America, placed in an economic, social, and literary context; emphasis placed on production, technological developments, economic structure, methods of distribu-

- tion and promotion, and book publishing as an art. Prerequisite: Library Science 400 or consent of instructor. 1 unit.
- 444. Evaluation of Information Services.** Methods for evaluating information retrieval systems, including dissemination systems and printed indexes; methodology of evaluation and factors affecting performance of systems. Prerequisite: Library Science 429 or consent of instructor. 1 unit.
- 445. Vocabulary Control of Information Retrieval.** The construction, characteristics, and application of controlled vocabularies for use in information retrieval systems; covers a full range of vocabulary control possibilities from highly structured thesauri and classification schemes to natural-language (free text) searching; special emphasis on the thesaurus and vocabulary control in computer-based systems. Prerequisite: Library Science 429. 1 unit.
- 450. Advanced Problems in Librarianship.** Directed and supervised investigation of selected problems in library resources, reference service, research libraries, reading, public libraries, or school libraries. Prerequisite: Fifth-year degree in library science or consent of director. $\frac{1}{2}$ to 2 units.
- 460. Special Topics in Librarianship.** An advanced seminar on topics of individual choice; presentation and criticism of written research reports based on individual study on an advanced level; and sections or practicum in research methods offered in the following areas: (a) historical, I; (b) survey; (c) observation; (d) experimental; and (e) historical, II. Students may enroll in a maximum of two sections, concurrently or consecutively. Open to doctoral students only. Prerequisite: Library Science 469 or consent of instructor. $\frac{1}{2}$ to 2 units.
- 465. Librarianship and Society.** Analysis of the role and functions of libraries in the twentieth century; the changing characteristics of information and knowledge viewed as major determinants of libraries' relations to society. Prerequisite: M.S. in library science or consent of instructor. 1 unit.
- 468. Education for Librarianship.** For those interested in preparing for teaching library science at the graduate level; analyzes current problems in library education in terms of the historical background, the current situation, and possible solutions. Prerequisite: M.S. in library science. 1 unit.
- 469. Principles of Research Methods.** Designed for persons planning to engage in research; reviews significant investigations in the library field and considers the use of hypotheses, the conduct of experiments, the nature of proof, and the employment of statistical methods, with a view to helping students develop their dissertations. Required for Ph.D. candidates. Prerequisite: Knowledge of the principles of statistics; M.S. in library science or consent of instructor. 1 unit.
- 499. Thesis Research.** Individual study and research. Section A: M.S. candidates, 0 to 2 units. Section B: doctoral candidates, 0 to 4 units.

LIFE SCIENCES

(Including Biology, Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology)

School Office: 387 Morrill Hall, Urbana

Biology

- 100. Biological Science, I.** Introduction to the biological sciences, their aims, content, and methods, with special reference to their application to human life and civilization. 4 hours.

101. **Biological Science, II.** Continuation of Biology 100. Prerequisite: Biology 100 or consent of instructor. 4 hours.
110. **Principles of Biology, I.** Heredity, evolution, diversity, reproduction, development, structure and function of cells, organisms, and populations. Prerequisite: One year of college chemistry, or concurrent enrollment in chemistry. 5 hours.
111. **Principles of Biology, II.** Continuation of Biology 110. Prerequisite: Biology 110. 5 hours.
115. **Heredity, Evolution, and Society.** Basic principles of heredity and evolution with emphasis on the significance to human society. Credit is not given for both Biology 115 and Biology 210 and for Zoology 106 or 107. Prerequisite: Four hours credit in a biological science. 4 hours.
151. **The Cell.** Study of cells from the molecular to the microscopic level of organization. Prerequisite: Credit or concurrent registration in organic chemistry; consent of Honors Biology Committee. 5 hours.
198. **Freshman Seminar.** Current topics in biology in the context of total culture. Participants are required to do independent library research and to present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
203. **Honors Seminar.** Lectures, student presentations, and discussions on selected topics of biology. Prerequisite: Junior or senior standing; 4.0 cumulative average; two courses in biology or consent of instructor. 1 hour. May be repeated once for credit.
210. **Genetics.** Principles of heredity and the nature of genetic material. Credit is not given for both Biology 210 and Biology 115, or Zoology 106. Prerequisite: Biology 111 or equivalent, or consent of instructor. 4 hours.
211. **Developmental Biology.** Introduction to basic mechanisms of organismic development as elucidated by descriptive and experimental methods. Prerequisite: Biology 111 or equivalent; a course in organic chemistry. 3 hours.
212. **Environmental Biology.** Lecture, discussion, laboratory, and field course dealing with the relationships between organisms and their environment; introduction to physiological bases for adaptations, population dynamics, community organization, and the structure and function of ecosystems. Prerequisite: One year of biology or consent of instructor. 5 hours.
251. **The Organism.** Study of the way different classes of organisms respond to challenges of their environment; emphasis on the general features of organismic behavior. Prerequisite: Biology 151; good standing in the honors biology program; consent of the Honors Biology Committee. 5 hours.
305. **Principles of Taxonomy.** Discussion of the development and current status of principles of taxonomy in general; detailed consideration of the evolutionary processes producing animal taxa and the phylogenetic and statistical concepts pertinent to their classification. Prerequisite: Biology 210 or equivalent. 3 hours or $\frac{3}{4}$ unit.
307. **Immunology.** Introduction to fundamentals of immunology with emphasis on biological application; basic background for understanding immunological responses and techniques applicable to biological research. Prerequisite: Four semesters of college biology; a course in organic chemistry, or consent of instructor. 4 hours or $\frac{3}{4}$ unit.
308. **Experimental Immunobiology.** Introduction to immunological laboratory techniques for solving biological problems and to experimental techniques in cellular immunology. Prerequisite: Credit or concurrent registration in Biology 307; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
310. **Principles of Population Biology, I.** Biology 310 and 311 provide an integrated treatment of population concepts in biology. Major topics: ecology, ethology, population genetics, and evolution. Prerequisite: Biology 210 or consent of instructor; college algebra. 3 hours or $\frac{3}{4}$ unit.
311. **Principles of Population Biology, II.** Continuation of Biology 310. Prerequisite: Biology 310 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

313. **Experimental Genetics.** Laboratory course to expose students to several types of organisms, experimental approaches, and methods of analysis utilized in genetical research. Prerequisite: Biology 151 or 210; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **Experimental Development.** Laboratory course to expose students to a variety of organisms, experimental approaches, and methods of analysis utilized in developmental research. Prerequisite: Biology 211 or 251, or Zoology 333; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Population Genetics.** Same as Dairy Science 316. The mathematical theory of the genetics of populations: estimation of gene frequency, Hardy-Weinberg principle, systems of mating, relationship between relatives, and forces that change gene frequency; applications to man, animals, and plants. Students desiring 4 hours or 1 unit credit will do additional work in some area of population genetics. Prerequisite: Dairy Science 110 or Biology 210 and college algebra; or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
351. **Population Biology.** Study of problems associated with behavior of plant and animal populations based on genetic, evolutionary, and ecological principles. Prerequisite: Biology 251; statistics; good standing in the honors biology program; consent of Honors Biology Committee. 4 hours or 1 unit.
371. **Quantitative Biology.** Theory and practical application in biology of probability and statistics; lectures and assigned problems. Prerequisite: College algebra; consent of instructor. 4 hours or 1 unit.
405. **Methods of Taxonomy.** Survey of basic procedure and techniques utilized in zoological classification. Major topics: assembly and arrangement of zoological materials; use of the fundamental taxonomic literature; descriptive and inferential statistical methods; data processing; and the interpretation and presentation of results and investigations. Prerequisite: Biology 305 or equivalent; a course in statistics. $\frac{3}{4}$ unit.
409. **History of Biology.** The development of biological concepts from the classical Greek period to the present. Prerequisite: Consent of instructor. 1 unit.
411. **Discussions in Genetics and Cytogenetics.** $\frac{1}{4}$ unit.
412. **Analysis and Control of Natural Environments.** Discussion and analysis of physiological, biochemical, and ecological aspects of environmental quality and of the problems of technology assessment; emphasis on the detection and characterization of environmental pollution, on the conservation of environmental quality, and on the applied ecology of the plant and animal populations. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
416. **Quantitative Genetics.** Same as Dairy Science 416. The mathematical theory of the genetics of quantitative traits: properties of random-mating populations; estimation of repeatability, hereditability, and genetic correlation; genetic results of selection; aids to selection; correlated response; selection for more than one trait; and applications to animals and plants. Prerequisite: Dairy Science 316 and 340, or consent of instructor. 1 unit.
418. **Concepts and Topics in Immunology.** Same as Veterinary Medical Science 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunologic tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor; Microbiology 327 and Biology 307 recommended. $\frac{1}{2}$ unit.
423. **Electron Microscopy.** Same as Chemistry 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission electron microscope and its modern variants; lectures and demonstrations of modern high vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics; consent of instructor. $\frac{1}{2}$ unit.
429. **Electron Microscopy with Laboratory.** Same as Chemistry 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate

- sections to meet special needs of biologists, geologists, and those interested in electron diffraction. Most theory lectures may be omitted by those concurrently enrolled or having credit in Biology 423 or Chemistry 423. Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics; two semesters of college mathematics; three semesters of chemistry; consent of instructor. 1 unit.
430. **Biological Ultrastructure.** Lectures and reports on the fine structure of plant and animal cells and cell products; discussions of possible relationships of ultrastructure to function and of diverse interpretations of chemical-physical information as ultrastructure. Prerequisite: Consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.
440. **Advanced Plant Physiology, I.** Comprehensive presentation of current knowledge in plant physiology. First semester of a two-semester sequence covering cell organization and function, respiratory and photosynthetic mechanisms, transport processes, nutrition, biosynthesis, growth, development, and reproduction. Prerequisite: Biochemistry 350 or Botany 330, or consent of instructor. 1 unit.
441. **Advanced Plant Physiology, II.** Comprehensive presentation of current knowledge in plant physiology. Second semester of a two-semester sequence covering cell organization and function, respiratory and photosynthetic mechanisms, transport processes, nutrition, biosynthesis, growth, development, and reproduction. Prerequisite: Biochemistry 350 and Botany 330, or consent of instructor. 1 unit.
450. **Ecological Methods, I.** Field and laboratory methods employed in ecological research. First semester of a two-semester sequence; covers methods involved in studying physical and chemical properties of soil, soil organisms, and measuring physical environmental factors. Prerequisite: A course in statistics; consent of instructor. 1 unit.
451. **Ecological Methods, II.** Field and laboratory methods employed in ecological research. Second semester of a two-semester sequence; covers sampling of populations and communities, and analysis of ecosystem functions. Prerequisite: Biology 450; consent of instructor. 1 unit.
452. **Ecology Seminar.** Discussion, review, and critical analysis of specific topics in ecology; required of all students in the ecology program. Prerequisite: Two courses in ecology; consent of instructor. $\frac{1}{4}$ unit. May be repeated to a total of 2 units.
453. **Analysis of Ecosystems.** Practical application of statistical techniques and computer technology to ecological problems; emphasis on model building for analysis of population dynamics, and structure and function of ecosystems; and individual problems. Prerequisite: Botany 381, Zoology 345 or Entomology 315, Biology 310 and 371, Mathematics 120, and Computer Science 121, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
457. **Ultrastructural Pathology.** Same as Veterinary Medical Sciences 457. Ultrastructural basis of pathologic processes occurring in animal tissues and cells; lectures, discussions and reports. Prerequisite: Zoology 430; consent of instructor. $\frac{3}{4}$ or 1 unit.
475. **College Biology Teaching Seminar.** Seminar in the teaching of biology for prospective college teachers. A second $\frac{1}{4}$ unit can be earned by completion of a project in an approved topic area. Prerequisite: Graduate standing in a program within the School of Life Sciences. $\frac{1}{4}$ to $\frac{1}{2}$ unit.
490. **Special Topics in Biology.** Individual topics in research and/or reading conducted under the supervision of faculty members in the School of Life Sciences. Designed for students enrolled in the biology program who would like to become more familiar with specialized fields of study prior to committing themselves to a specific area for their doctorate degree. $\frac{1}{2}$ to 2 units.
493. **Advanced Electron Microscopy.** Same as Chemistry 493. Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, and the analysis and study of varied materials by use of transmission and/or scanning electron mi-

croscopes, and by the techniques of electron diffraction. Open to qualified students in all departments. Prerequisite: Biology 429; consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.

499. Thesis Research. 0 to 4 units.

Botany

Head of Department: Professor J. B. Hanson

Department Office: 289 Morrill Hall, Urbana

- 100. General Botany.** Basic principles of growth and form, physiology, genetics, evolution, and ecology in plant biology. Students may not receive credit for both Botany 100 and 101. 4 hours.
- 101. General Botany for Selected Students.** Provides instruction in the structure, physiology, reproduction, ecology, and economic importance of plants; instruction adjusted to the level of the selected student and consists of demonstration, discussion, and lecture. Admission to each section is limited to fifteen students. Students may not receive credit for both Botany 101 and 100. Prerequisite: James Scholar standing or consent of instructor. 5 hours.
- 204. Natural History of Plants.** Diversification and distribution of plants in time, space, and culture; evolution and dispersion of plants in nature and under the influence of selection and utilization by man; natural and artificial selection of important plant types and structures; and plant geography as determined by climate, geology, and cultivation. Prerequisite: Botany 100 or 101, or equivalent. 3 hours.
- 234. Form and Function in Flowering Plants.** Lecture course on the physiological and morphological attributes that underlie the biosynthesis, growth, and reproduction of flowering plants in relation to the environment. Prerequisite: Botany 100 or 101, or a year of biology; Chemistry 102. 3 hours.
- 260. Introductory Plant Taxonomy.** Classification and identification of flowering plants, with special reference to the local flora and to the needs of high school teachers. Occasional field trips required. Prerequisite: Botany 100 or 101, or Biology 111. 3 hours.
- 300. Individual Topics.** For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than 5 hours in Botany 300 toward a bachelor's degree, nor may graduate students more than 1 unit in Botany 300 toward a master's degree. Prerequisite: Botany 100; 10 hours of advanced work in botany or another biological science; senior standing. 2 to 5 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit.
- 304. General Plant Morphology.** Lecture and laboratory course dealing with the structure, reproduction, and evolution of representative algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms. Prerequisite: Botany 100, Biology 101, 111, 251, or consent of instructor. 4 hours or 1 unit.
- 325. Paleobotany.** Same as Geology 325. Structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips are included. Prerequisite: Botany 100 or Biology 101, and Geology 101, or consent of instructor. 5 hours or 1 unit.
- 330. Plant Physiology.** General course concerned with plant functions, including water relations, mineral nutrition, metabolism, growth, and reproduction. Prerequisite: Chemistry 131; Botany 100, or Biology 101, 111, or 251. 3 hours or $\frac{1}{2}$ unit.
- 331. Experimental Cytology.** Same as Zoology 331. Lectures on structure and function of the cell; coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or 251; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 333. Plant Physiology Laboratory.** Same as Agronomy 333 and Horticulture 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of experimental plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.

334. **Experimental Cytology Laboratory.** Same as Zoology 334. Introduction to cytological techniques, microscopic analysis of macromolecules, isotopic techniques, and autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.
341. **Field Ecology.** Study of plant communities in various sections of North America during spring vacation. Trips rotate on a three- to five-year basis. Outdoor cooking and camping; transportation in University cars. Prerequisite: One of the following: Botany 260, 366, 381, or 385; consent of instructor. 1 hour or $\frac{1}{4}$ unit. May be repeated for a maximum of 3 hours or $\frac{3}{4}$ unit.
345. **Plant Anatomy.** Study of the internal structure of vascular plants with special emphasis on development, function, and evolutionary history. Prerequisite: One year of botany. 4 hours or 1 unit.
350. **Phycology.** Introductory lecture and laboratory to the ecology, morphology, physiology, and systematics of the algae. Prerequisite: One year of botany or another biological science, or consent of instructor. 4 hours or 1 unit.
351. **Viruses, I.** Same as Microbiology 351 and Zoology 351. An introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200, or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.
352. **Viruses, II.** Same as Microbiology 352 and Zoology 352. Extension of the principles developed in Botany 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Botany 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or $\frac{3}{4}$ unit.
366. **Field Botany.** Identification and classification of native and naturalized flowering plants of eastern North America. Prerequisite: One course in botany; consent of instructor. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. Offered in the summer session only.
372. **General Mycology.** Structure, classification, and identification of fungi, including those of economic importance. Prerequisite: One year of botany, entomology, microbiology, or zoology; senior standing or consent of instructor. 4 hours or 1 unit.
381. **Plant Ecology.** Principles of ecology exemplified by vegetation and environments of Illinois. Prerequisite: Botany 260 or equivalent. 5 hours or 1 unit.
402. **Molecular Genetics: Chromosome Mechanics.** Same as Microbiology 402 and Zoology 402. Structure and behavior of chromosomes (including replication, repair, complementation, recombination, and mutation); emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or equivalent. $\frac{3}{4}$ unit.
403. **Physiology of Fungi.** Same as Plant Pathology 403. Germination, growth, metabolism, and sporulation of fungi; physiology of fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products; and discussion of the nature of fungicidal activity. Prerequisite: Organic chemistry or biochemistry; mycology; Plant Pathology 204 or equivalent; microbiology. 1 unit. Offered in alternate years.
405. **Molecular Genetics: Gene Action.** Same as Microbiology 405 and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with intracellular transmission of genetic information; gene regulation, transcription, and translation. Prerequisite: Microbiology 316 or 330; mathematics through calculus; or consent of instructor. $\frac{3}{4}$ unit.
410. **Botany Discussions.** All graduate students in botany, except those with conflicting teaching assignments, are required to register in and attend the general seminar. No credit given except to those students presenting the results of their Ph.D. thesis research. 0 or $\frac{1}{4}$ unit.
413. **Discussions in Plant Physiology.** $\frac{1}{4}$ unit.
414. **Discussions in Plant Morphology and Taxonomy.** $\frac{1}{4}$ unit.
418. **Discussions in Plant Ecology and Plant Geography.** Developments in ecology and plant geography, with emphasis on one special division. Prerequisite: Graduate standing in botany, entomology, geography, or zoology. $\frac{1}{4}$ unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.

419. **Discussions in Photosynthesis and Related Topics.** Prerequisite: Consent of instructor. Students may accumulate 1 ½ units. 0 or ¼ unit.
421. **Cytogenetics.** Same as Zoology 421. Chromosome theory: structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210 or Microbiology 330, or consent of instructor. 1 unit. Offered in alternate years.
424. **Mineral Nutrition of Plants.** Same as Agronomy 424 and Horticulture 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in light of metabolic activity and constituency in functional plant compounds; major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
427. **Discussions in Mycology.** Seminar course designed for discussion of current research in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. Prerequisite: Consent of instructor. ¼ unit.
433. **Advanced Physiology of Growth, Responses, and Reproduction.** Prerequisite: Botany 330 or equivalent. 1 unit.
436. **Advanced Plant Physiology: Photosynthesis.** Same as Agronomy 436. Lecture and laboratory dealing with physiological, biochemical, and biophysical aspects of photosynthesis. Prerequisite: One year each of college biology, chemistry, and physics, or consent of instructor. 1 unit. Offered in alternate years.
442. **Environmental Plant Physiology.** Same as Agronomy 442. Lecture course dealing with the interaction of plants and environment at the level of the whole organism, extending to the cell and the community; emphasis on heat and mass transfer, plant and soil potentials, and effects of light on growth. Prerequisite: Chemistry 131; general physics; general or plant physiology; consent of instructor. 1 unit.
460. **Advanced Taxonomy of Flowering Plants, I.** Phylogenetic study of flowering plants; relationship of the principal orders and families; problems of nomenclature; and identification of specimens. Prerequisite: Botany 260 or one year of botany or another biological science, or consent of instructor. ½ or 1 unit. Offered in alternate years.
461. **Advanced Taxonomy of Flowering Plants, II.** The application of cytology, ecology, genetics, and morphological analyses to the study of evolution and the natural relationships of populations as exemplified by species of higher plants. Prerequisite: Botany 260 and Biology 210, or equivalent; consent of instructor. 1 unit. Offered in alternate years.
462. **Origin of Variation in Plants.** Same as Agronomy 462. Study of the principles of plant evolution; discussion of theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaptation. Prerequisite: Consent of instructor. 1 unit.
463. **Plant Products.** Lectures on the natural products from plants and the plant groups in which these compounds occur; discussions include the biosynthesis, biological functions, relevant chemistry, toxicity, and economic importance of plant products. Prerequisite: Biochemistry 350 or consent of instructor. ¾ unit.
471. **Advanced Mycology: Special Groups.** The several classes of fungi and their activities are considered in successive semesters. Special groups within these classes may be selected for concentrated study, depending upon the student's interest in mycology. Prerequisite: Botany 372 or consent of instructor. ½ unit.
485. **Plant Geography of North America.** Study of principles of plant geography, plant distribution in relation to environment, and vegetational units of North America. Prerequisite: Botany 381 or equivalent. 1 unit. Offered in alternate years.
493. **Advanced Studies in Botany.** Not more than 1 unit may be applied toward the Graduate College master's degree requirement of 3 units of course work at the 400 level. Work may be taken in the following areas: (a) anatomy; (b) biochemical cytology; (c) biological rhythms; (d) cytogenetics and speciation; (e) ecology; (f) genetics; (g) morphogenesis and development; (h) morphology; (i) mycology; (j) paleobotany; (k) photosynthesis; (l) phycology; (m) physiology; (n) taxonomy; (o) ultrastructure; and (p) virology. ½ to 2 units.

499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

Entomology

Head of Department: Professor J. R. Larsen

Department Office: 320 Morrill Hall, Urbana

101. **Agricultural Entomology.** Lectures and discussion with laboratory practice in the recognition of agricultural pests for students of agriculture; covers methods of injury by insects; their structure, physiology, metamorphosis, classification, and control; recognition, nature of injury, life history, and habits; and control of the more common destructive or annoying pests of field crops, vegetables, fruits, stored products, and domestic animals. Counts for credit in technical agriculture. 3 hours.
103. **Life of Insects.** Nontechnical course designed to give a balanced comprehensive picture of insect life; treats insect structures, growth, and relationships with other animal groups; life histories of the principal groups; modes of reproduction, movement, protection, communication, and behavior; interrelations with the physical and biotic environment, parasitism, transmission of diseases, predatism, and pollination; and includes how insects benefit and injure man, their control, and their roles in the history of man and in the arts. Credit is not given for both Entomology 103 and 118. 4 hours.
118. **Insects, Man, and Environment.** Nontechnical course which considers basic aspects of entomology and ecology, especially as they relate to problems in the use of pesticides and environmental pollution. Credit is not given for both Entomology 118 and 103. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
301. **Introduction to Entomology.** Same as Zoology 301. Integrated studies of the principal morphological, physiological, and ecological relationships of insects. Prerequisite: Biology 111; Chemistry 131; consent of instructor. 5 hours or 1 unit.
302. **Classification of Insects.** Comprehensive survey of the systematics and phylogeny of the orders and principal families of insects, with practical experience in identification of these taxa. Prerequisite: Consent of instructor. 4 hours or 1 unit. Offered in the summer session only.
306. **Special Problems.** For students ready to undertake special investigation to be completed as an undergraduate study or as the beginning of a thesis problem for an advanced degree. It also may be used to prepare a thesis for scholastic honors. Prerequisite: Consent of instructor. May be taken by students who can only attend classes on Saturday morning. 2 to 5 hours, or $\frac{1}{4}$ to 1 unit.
312. **Entomology for Teachers.** Recognition of the chief orders of insects in their immature and adult stages; how they develop, life cycles, food, and habitats; adaptations for feeding, oviposition, movement, protection, defense, sound making and other functions; interrelations with other organisms and the environment; and social life. A collection of insects is mounted, labelled, and identified. Field trips, laboratory work, and discussions. Prerequisite: One year of biology, botany, zoology, or equivalent. 3 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
315. **Insect Ecology.** Discussion of the practical and theoretical aspects of ecology in relation to insects as individuals, populations, and communities; emphasis on the role of insects in the environment. Prerequisite: Biology 312 or consent of instructor. 4 hours or 1 unit.
319. **Fundamentals of Insect Control.** Emphasis on the principles underlying control of important insect pests of agriculture and human and animal health; study of integrated pest control involving biological, cultural, and chemical factors and of the ecology of the use of pesticides in the total environment. Prerequisite: Biology 111 and Chemistry 101, or equivalent; consent of instructor. 4 hours or 1 unit.

322. **Insect Bionomics.** Biology of insects dealing with life history and conditions of environment that favor abundance of insects representative of various habitats. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Horticulture 361 and Zoology 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or ½ unit.
410. **Insect Morphology.** Comprehensive study of internal and external structures of insects from the comparative viewpoint. Prerequisite: Biology 111 or equivalent; consent of instructor. 1 unit.
413. **Medical and Veterinary Entomology.** Training in recognition, classification, methods of injury, habits, and control or destruction of insects, mites, and ticks which are predators, parasites, or disseminators of disease among men and domestic animals. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 1 unit.
420. **Chemistry and Toxicology of Insecticides.** Designed to provide fundamental information concerning the mode of action, the relationship of chemical structure to toxicity, and the physiological explanation of the chemical poisoning of insects. Prerequisite: One year of biology or equivalent in animal science; organic chemistry; consent of instructor. 1 unit.
422. **Insect Physiology.** Study of principal physiological and biochemical functions of insects, exclusive of sensory functions. Prerequisite: Entomology 302 and 410; organic chemistry; consent of instructor. 1 unit.
423. **Insect Behavior.** Analysis of the physiological basis of insect behavior, including a thorough study of the various sensory systems. Prerequisite: Entomology 301 or equivalent; consent of instructor. 1 unit.
424. **Advanced Insect Physiology.** Comprehensive study of physiological and biochemical interactions between the insect and its environment including sensory mechanisms, attractants and repellants, nutritional specialization, intermediary metabolism, energy production and utilization, metabolic activity accompanying functional changes, and process controls. Prerequisite: Entomology 422; Biochemistry 350; consent of instructor ¼ to 1 unit.
426. **Seminar in Entomology.** Discussions, reviews, and appraisals of special topics in the field of entomology. Prerequisite: Consent of instructor. 0 or ¼ unit. May be repeated for a maximum of 1 unit.
499. **Thesis Research.** Work may be taken in the following subjects: morphology and embryology of insects; applied entomology; systematic entomology; biology and ecology of insects; insect toxicology; and insect physiology. 0 to 4 units.

Microbiology

Head of Department: Professor R. D. DeMoss
Department Office: 131 Burrill Hall, Urbana

100. **Introductory Microbiology.** Introduction to the principal activities and properties of microorganisms, including bacteria, yeasts, molds, and viruses; consideration of the role of natural processes, such as photosynthesis; and man's use and control of microorganisms in the production of antibiotics and vaccines in industrial fermentations, in sanitation and public health, and in agriculture. Credit is not given for more than one of the following: Microbiology 100, 113, or 200. 3 hours.
101. **Introductory Experimental Microbiology.** Laboratory introduction to the techniques employed in the investigation of microbial activities and properties; experiments designed to familiarize the student with the handling, identification, and characterization of microorganisms and their activities, particularly those of interest to man. Credit is

- not given for both Microbiology 101 and 201. The course terminates at mid-semester. Prerequisite: Credit or concurrent registration in Microbiology 100. 2 hours.
113. **Man and Microbes.** General education biological science course for nonscience majors; examines the effects of microbes on the activities of man; emphasizes environmental, economic, and disease effects of microbial activity on society; and presents microbiology as an example of a modern biological science. Credit is not given for more than one of the following: Microbiology 113, 200, or 100. 3 hours.
200. **Microbiology.** Emphasis on fundamental concepts of microbiology, including nutrition, ecology, and physiology of microorganisms, and their role in nature and in infection and immunity. Credit is not given for more than one of the following: Microbiology 200, 100, or 113. Prerequisite: Credit or concurrent registration in organic chemistry. 3 hours.
201. **Experimental Microbiology.** Laboratory emphasizing the fundamentals of microbiology, including the biochemical basis of microbial physiology, ecology, and nutrition; microbial genetics and gene-enzyme relationships. Emphasis and encouragement are given to the experimental approach to microbiology. Credit is not given for both Microbiology 201 and 101. Prerequisite: Credit or concurrent registration in Microbiology 200 and in organic chemistry. 3 to 5 hours.
207. **Research and Special Problems.** Prerequisite: Fifteen hours of microbiology; consent of instructor. 3 to 5 hours. May be repeated for a maximum of 10 hours.
290. **Senior Thesis.** Research under the direction of a senior staff member in microbiology. Normally, the student takes two semesters of Microbiology 290 in the senior year. Recommended for all those planning future research and graduate study; prerequisite for graduation with distinction in microbiology. In the semester preceding initial enrollment, interested students should consult with their advisors concerning the procedures for enrollment. A minimum of 2 hours per senior semester is required, and a thesis must be presented for credit to be received, but graduation with distinction is not an automatic result of enrollment in Microbiology 290. Prerequisite: Consent of senior thesis adviser. 2 to 6 hours. May be repeated for a maximum of 10 hours.
309. **Comparative Microbial Chemistry.** Emphasis on comparative biochemical activity and other chemical characteristics as a basis for discussion of the features of major groups of microorganisms; stress on comparison of the energy metabolism of microbial groups. Prerequisite: Biochemistry 350 or equivalent. 2 hours or $\frac{1}{2}$ unit.
311. **Food and Industrial Microbiology.** Relationship of microorganisms to food manufacture and preservation, to industrial fermentation and processing, and to sanitation. Prerequisite: Microbiology 101, 201, or 309, or equivalent; credit or concurrent registration in organic chemistry laboratory, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Techniques of Applied Microbiology.** Consideration, through experimentation, of properties of bacteria, yeasts, molds, and actinomycetes important to industrial processes; exploration of methods of control of microbial processes in industry and sanitation. Prerequisite: Credit or concurrent registration in Microbiology 311. 2 hours or $\frac{1}{2}$ unit.
316. **Genetic Analysis of Microorganisms.** Prokaryotic and eucaryotic microbial genetic systems; emphasis on typical data analyses, together with the basic classes of genetic phenomena. Prerequisite: General genetics, Microbiology 200, or Microbiology 330. 3 hours or $\frac{3}{4}$ unit.
326. **Pathogenic Bacteriology.** Study of parasitism and pathogenic microorganisms; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, and methods of differentiation and recognition; and diseases microorganisms cause. Lectures and laboratory. Prerequisite: Microbiology 101, 201, or 309; organic chemistry laboratory. 5 hours or 1 unit.
327. **Immunochemistry.** Survey of the field of immunology with emphasis on its chemical aspects. Lectures and laboratory. Prerequisite: Credit or concurrent registration in biochemistry, or consent of instructor. 5 hours or 1 unit.
330. **Molecular Biology of Microorganisms.** Modern contributions to the science of microbiology; emphasis on the structure, function, and synthesis of informational macromol-

ecules and on the role microorganisms have played in molecular biology. Prerequisite: Microbiology 200 or equivalent; credit or concurrent registration in biochemistry. 3 hours or $\frac{3}{4}$ unit.

331. Microbial Physiology and Anatomy. Discussions and problems concerning growth, physiology, anatomy, and death of microorganisms. Prerequisite: Microbiology 200 or equivalent; Biochemistry 350 or equivalent. 3 hours or $\frac{3}{4}$ unit.

351. Viruses, I. Same as Botany 351 and Zoology 351. An introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200, or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.

352. Viruses, II. Same as Botany 352 and Zoology 352. Extension of the principles developed in Microbiology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Microbiology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or $\frac{3}{4}$ unit.

402. Molecular Genetics: Chromosome Mechanics. Same as Botany 402 and Zoology 402. Structure and behavior of chromosomes (including replication, repair, complementation, recombination, and mutation) with emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or consent of instructor. $\frac{3}{4}$ unit.

405. Molecular Genetics: Gene Action. Same as Botany 405 and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, including gene regulation, transcription, and translation. Prerequisite: Microbiology 330 or 316, and biochemistry, or consent of instructor. $\frac{3}{4}$ unit.

409. Cultivation and Properties of Microorganisms. Nutritional and metabolic properties of the major groups of microorganisms; a comparative study of the ecology, selective isolation, and cultivation of bacteria. Laboratory. Prerequisite: Biochemistry 355 or equivalent; credit or concurrent registration in Microbiology 309; consent of instructor. 1 unit.

412. Advances in Microbiology. Discussions of current research in the following areas of microbiology: (a) general microbiology; (b) microbial physiology and metabolism; (c) immunochemistry; and (d) molecular genetics. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated for a maximum of 1 unit.

419. Animal Virology. Same as Veterinary Medical Science 419. Discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327, or Veterinary Pathology and Hygiene 331 and 332; Biochemistry 350 or 354; consent of instructor. $\frac{3}{4}$ unit.

451. Experimental Virology. Experiments on the biology, replication, and genetics of bacteriophages, with emphasis on experimental design by the student. Prerequisite: Microbiology 351; consent of instructor. 1 unit.

490. Individual Problems. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.

495. Seminar. Required of all graduate students whose major is microbiology. Prerequisite: Ten hours of microbiology; consent of instructor. 0 or $\frac{1}{4}$ unit.

499. Thesis Research. 0 to 4 units.

Physiology and Biophysics

Head of Department: Professor W. W. Sleator

Department Office: 524 Burrill Hall, Urbana

Biophysics

199. **Undergraduate Open Seminar.** 0 to 9 hours.
301. **Introduction to Biophysics.** Review of the field of biophysics designed to introduce the student to types of biological problems currently under investigation in biophysics laboratories. Prerequisite: Eight hours of physics. 3 hours or $\frac{3}{4}$ unit.
312. **Introduction to Radiobiology.** Nature and mechanisms of the biological consequences of low dose and chronic irradiation. Intended primarily for students in engineering and physical sciences. Prerequisite: Mathematics 141, or 140 and 145; 8 hours of physics; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
401. **Advanced Biophysics, I.** Topics from membrane biophysics and bioenergetics. Prerequisite: Credit or concurrent registration in Physiology 403; one year of physics beyond introductory physics, or equivalent; calculus; consent of instructor. 1 unit.
402. **Advanced Biophysics, II.** Topics from sensory nerve and muscle biophysics, and response of biological systems to radiation phenomena (ionizing and mechanical). Prerequisite: Biophysics 401 or consent of instructor. 1 unit.
404. **Physiological Measurements.** Same as Physiology 404. Laboratories concerned with introducing at a graduate level current research techniques in physiological and biophysical sciences; problem-oriented laboratories; students select up to four special topics representing different areas of physiology and biophysics, such as mammalian and human, molecular, cellular and radiation biology, comparative physiology, and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.
406. **Principles of Biophysical Measurements.** Lecture course designed to acquaint the student with physical methods useful in the solution of biological problems; topics covered include bioelectric measurements, including basic electronics; optical methods, including microscopy, spectrophotometry, and measurement of action spectra; use of high-energy radiations; tracer techniques; and acoustical techniques. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit.
410. **Special Topics in Biophysics.** Advanced course on some topic of interest in biophysics, such as electrophysiology, radiation biology, photobiology, bioacoustics, or the physics of muscular contraction. Prerequisite: Biophysics 401 and 402, or equivalent. $\frac{1}{2}$ to 1 unit.
411. **Seminar.** Survey of literature in one area of biophysics, with special emphasis on student reports. Prerequisite: Enrollment in the biophysics program or consent of instructor. $\frac{1}{2}$ unit.
463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Veterinary Medical Science 463 and Animal Science 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, and biology, and/or consent of instructor. 1 unit.
491. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** Research may be conducted in one of the areas listed below, subject to approval of the staff member concerned and the department in which the research is to be done: (a) bioacoustics; (b) biophysics of excitable membranes; (c) physical properties of lipids and membranes; (d) lipid biophysics, model membranes, and pollution effects; (e) photobiology and photosynthesis; (f) biophysics of muscular contraction; (g)

radiobiology; (h) information theory and cybernetics; (i) ion transport and permeability; (j) mechanical properties of tissues; (k) biophysical sensory biophysics. 0 to 4 units.

Physiology

101. **Introduction to Human Physiology:** Physical and Chemical Bases of Cell Function, Principles of Physiological Control Systems, Coordinated Body Functions. Emphasizes those aspects especially illustrative of general principles of biology; designed to be one-half of a student's life sciences general education requirement; especially suitable for coupling with an anthropology or psychology course. Prerequisite: High school chemistry strongly recommended. 3 hours. Credit will not be given for Physiology 101 and any of the following: Physiology 102, 103, 104, 105, or 106.
102. **Introduction to Human Physiology:** Principles of Physiological Control Systems, Coordinated Body Functions, Physiological Bases of Behavior. Emphasizes those aspects which make physiology unique among the life sciences; designed to be one-half of a student's life sciences general education requirement; especially suited for coupling with another course in biology. Prerequisite: A college course in biology or equivalent (for example, 3 hours credit or credit waiver via CLEP examination). 3 hours. Credit will not be given for Physiology 102 and any of the following: Physiology 101, 103, 105, 106, or 107.
103. **Introduction to Human Physiology:** The Physical and Chemical Bases of Cellular Function, Principles of Physiological Control Systems, Coordinated Body Functions, Physiological Bases of Behavior. Prerequisite: High school chemistry strongly recommended. 4 hours. Credit will not be given for Physiology 103 and any of the following: Physiology 101, 102, 104, 105, 106, or 107.
104. **Physical and Chemical Bases of Cell Function:** Scientific Method, Nature of Biological Systems, Cell Metabolism, Heredity. Prerequisite: High school chemistry strongly recommended. 1 hour. Credit is not given for Physiology 104 and any of the following: Physiology 101 or 103.
105. **Principles of Physiological Control Systems:** Nature of Nerve Impulse, Neural and Hormonal Control Mechanisms, Homeostatic Mechanisms. Prerequisite: Either (a) credit or concurrent registration in Physiology 104, or (b) a college life science course, or (c) 3 hours credit or credit waiver via CLEP examination. 1 hour. Credit will not be given for Physiology 105 and any of the following: Physiology 101, 102, or 103.
106. **Coordinated Body Functions.** Study of the cardiovascular, renal, respiratory, and digestive systems. Prerequisite: Credit or concurrent registration in Physiology 105. 1 hour. Credit will not be given for Physiology 106 and any of the following: Physiology 101, 102, or 103.
107. **Physiological Bases of Behavior.** Processing of sensory information; physiological correlates of consciousness and behavior; motor control; and reproduction and sex. Prerequisite: Credit or concurrent registration in Physiology 101 or 106. 1 hour. Credit will not be given for Physiology 107 and any of the following: Physiology 102 or 103.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
234. **Human Anatomy and Physiology.** Study of the essentials of anatomy and physiology with special reference to muscular and nervous systems. Prerequisite: Physiology 103 or consent of instructor. 5 hours.
290. **Reading and Individual Topics Course.** Readings or laboratory work in fields chosen in consultation with a departmental faculty sponsor. Must be taken in partial fulfillment of departmental honors requirements. Prerequisite: A course in physiology; consent of instructor. 2 to 4 hours. May be repeated for a maximum of 10 hours.
291. **Discussions in General Physiology.** Discussions of selected topics in general physiology. Prerequisite: Credit or concurrent registration in Physiology 301; consent of instructor. 2 hours.

292. **Discussions in Animal Physiology.** Discussions of selected topics in animal physiology. Prerequisite: Credit or concurrent registration in Physiology 302; consent of instructor. 2 hours.
301. **General Physiology.** A consideration from the standpoint of experimental biology of functions that are common to most eukaryotic cells. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or $\frac{3}{4}$ unit.
302. **Animal Physiology.** Organ physiology of animals; emphasis on homeostasis and physiological interactions of animals with their environment. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or $\frac{3}{4}$ unit.
303. **General Physiology Laboratory.** An introduction to experimentation with cellular functions common to most eukaryotic cells; emphasis on biochemical, radioactive tracer, electrical, and mechanical recording techniques. Prerequisite: Credit or concurrent registration in Physiology 301. 2 hours or $\frac{1}{4}$ unit.
304. **Experimental Physiology Laboratory.** Introduction to problems and techniques for studying the physiology of organ systems. Prerequisite: Credit or concurrent registration in Physiology 302. 2 hours or $\frac{1}{4}$ unit.
305. **Principles of Ergonomics.** Same as Industrial Engineering 305 and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Industrial Engineering 306 and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
312. **Endocrinology.** Same as Zoology 312. Physiology and biochemistry of the endocrine system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
331. **General Radiobiology.** Response of multicellular organisms, cells, and macromolecules to ionizing radiations. Lectures, student reports, and discussions. Prerequisite: One year each of mathematics, physics, chemistry, and biology. 4 hours or 1 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Psychology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man; geographical elements; morphological adaptations; physiological, psychological, and sociological adjustments to environment; regulation of populations; and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. Term paper required for credit; depending upon the nature and magnitude of this paper, the credit may be 3 or 5 hours.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Psychology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Physiology 369. 4 hours or 1 unit.
401. **Physiology of Systems and Organs.** Analysis of organization and function of vertebrate systems, which combines the viewpoints of traditional cellular, comparative, mammalian, and human physiology; nervous, circulatory, digestive, and excretory systems; and

gross metabolism. Prerequisite: One year of college-level physics; chemistry through organic; an upper-division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.

402. **Comparative and Adaptational Physiology.** Analysis of mechanisms of adaptation to the environment and to environmental stress, which combines viewpoints of traditional cellular, mammalian, and human physiology; particular emphasis on the comparative approach; homeostatic theory, nutrition, osmotic and ionic regulation in cell membranes; and respiration and metabolism, temperature relations, sense organs, and contractile systems. Prerequisite: One year of college-level physics; chemistry through organic; an upper-division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.
403. **Cellular and Molecular Physiology.** Physicochemical analysis of cellular function and structure; consideration of the implications of the properties of cells for the physiology of multicellular animals. Students may enroll for the lecture series on physiology of cytoplasm and the nucleus, cell growth and division and cellular regulatory mechanisms, and/or for the lecture series on cellular ultrastructure, physiology of cell membranes, bioelectrics, and motility. Prerequisite: One year of college-level physics; chemistry including physical and biochemistry; an upper-division course in physiology; knowledge of calculus presumed. $\frac{1}{2}$ or 1 unit.
404. **Physiological Measurements.** Same as Biophysics 404. Laboratories concerned with introducing at a graduate level current research techniques in the physiological and biophysical sciences; problem-oriented laboratories; students select up to four special topics representing different areas of physiology and biophysics, such as mammalian and human, molecular, cellular and radiation biology, comparative physiology, and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.
410. **Mammalian Physiology Seminar.** Current trends in mammalian physiology. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. $\frac{1}{2}$ unit.
412. **Advanced Endocrinology.** Same as Animal Science, Dairy Science, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated for a maximum of 2 units.
413. **Experimental Mammalian Physiology, I.** Same as Veterinary Medical Science 413. Physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
414. **Experimental Mammalian Physiology, II.** Same as Veterinary Medical Science 414. Physiological applications of experimental pharmacodynamics. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
416. **Structure and Function of the Nervous System.** Understanding of nervous function through the experimental approach. Prerequisite: Two semesters of physiology courses beyond the elementary level; two semesters of general physics; consent of instructor. 1 unit.
421. **Gross Human Anatomy.** General survey of the structures of the human body with emphasis on the relations between form and function. Prerequisite: One semester of embryology; consent of instructor. 1 unit.
431. **Experimental Radiobiology.** Laboratory exercises in irradiation procedures and in examination of biological responses to ionizing radiations. Prerequisite: Physiology 331 or equivalent; consent of instructor. 1 unit.
441. **Advanced Comparative Physiology.** Same as Zoology 441. Seminar, lectures, student reports, and discussions. Topics rotate in three-year cycle: adaptational physiology, comparative neurophysiology, and comparative physiology of motile mechanisms. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
442. **Advanced Comparative Physiology Laboratory.** Same as Zoology 442. Laboratory experiments presenting comparative principles in osmotic and ionic regulation; respira-

- tion and metabolism; temperature regulation of animals; and physiology of circulatory systems, of muscle, of sense organs, and of nervous systems. Prerequisite: Physiology 402, 403, and 404; credit or concurrent registration in Physiology 441. 1 unit.
451. **Advanced Cellular Physiology.** Same as Zoology 451. Seminar, lectures, student reports, and discussions. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
470. **Human Pathologic Physiology.** Disturbances of function in tissues and organs and their relationship to the pathogenesis of human disease. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. $\frac{3}{4}$ unit.
472. **Human Physiology Seminar.** Topics of current emphasis in human physiology. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. $\frac{1}{2}$ unit.
473. **Ergonomics Seminar.** Same as Industrial Engineering 473 and Physical Education 473. Topics in ergonomics explored in depth, such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Physiology, Physical Education, or Industrial Engineering 306, or consent of instructor. $\frac{1}{2}$ unit.
491. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Approval of department. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** Research may be conducted in the following areas, with the consent of the instructor: (a) cellular physiology; (b) comparative physiology; (c) mammalian physiology; (d) human anatomy and human physiology; (e) endocrinology; (f) neurophysiology; (g) radiobiology; and (h) environmental and stress physiology. 0 to 4 units.

Zoology

Department Office: 515 Morrill Hall, Urbana

104. **Elementary Zoology.** Fundamental principles of the structure, physiology, reproduction, ecology, and evolution of animals; special emphasis on their relations to human life. This course with Botany 100 meets the biology requirement for students in agriculture. 4 hours.
105. **The Ecosystem Concept.** Introduction to ecological principles; particular emphasis on man in relation to his global environment; evolution of man and the human ecosystem; and consideration of effects of human population growth, energy production, and natural resource utilization as they affect global cyclic mechanisms. 3 hours.
106. **Principles of Heredity.** Introduction to genetics and the laws of inheritance with special emphasis on man; the relationship of genetics to human affairs. No biological training required. Credit is not given for both Zoology 106 and Biology 115 or 210. Prerequisite: Sophomore standing. 3 hours.
107. **Evolution.** Analysis of the theories of evolution, the mechanism of evolutionary changes, and the evolution of man. Credit is not given for both Zoology 107 and Biology 115. Prerequisite: Sophomore standing. 3 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology and Home Economics 143. Critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
232. **Comparative Vertebrate Anatomy.** Classification and comparative anatomy of vertebrates including functions and evolution of their organs and organ systems. Prerequisite: Biology 111 or equivalent. 5 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology, and Sociology 246. Introduction to the biosociology of vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.

300. **General Seminar.** For members of the staff and graduate students. Required of all graduate students but also open to seniors whose major is zoology. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar, Endocrinology Seminar, and Protozoology-Parasitology Seminar. No credit.
301. **Introduction to Entomology.** Same as Entomology 301. Integrated studies of the principal morphological, physiological, and ecological relationships of insects. Prerequisite: Biology 111; Chemistry 131; consent of instructor. 5 hours or 1 unit.
303. **Individual Topics.** Graduates may register for topics involving individual work not assigned in other courses. Laboratory conferences, and readings. Prerequisite: Two years of zoology; senior standing; approval of department. May be taken by students who can attend classes only on Saturdays. 2 to 5 hours, or $\frac{1}{2}$ or 1 unit.
304. **Field and Systematic Zoology.** Collection, preservation, and identification of lower vertebrates and land and fresh-water invertebrates: habits and life histories of selected forms. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.
312. **Endocrinology.** Same as Physiology 312. Physiology and biochemistry of the endocrine system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
315. **Human Genetics.** Study of the techniques required for genetic analysis of human traits; discussion of genetic mechanisms operative in human development, metabolism, and behavior; and genetics and human disease. Prerequisite: Biology 210; biochemistry and statistics recommended. 3 hours or $\frac{3}{4}$ unit.
318. **Protozoology.** Basic treatment of the morphology, physiology, and systematics of the protozoa; consideration of their evolution, ecology, morphogenesis, sexual phenomena, genetics, and parasitism with life histories of selected free-living and parasitic forms. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
320. **Invertebrate Zoology.** Invertebrates; structure and development; application of biological principles; specific and comparative morphology of the invertebrates; and coordination of structure and function, origin, development, and life histories. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
321. **Parasitology.** Worm parasites: life cycles, morphology, taxonomy, and environmental relations; lecture, laboratory, technic, readings, quiz, demonstrations, and problems. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
330. **Practical Microtechnique.** Introduction to microscopy, microphotography, and histological technique. Prerequisite: Histology or embryology; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
331. **Experimental Cytology.** Same as Botany 331. Lectures on structure and function of the cell; coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
332. **The Evolution of Adaptive Systems.** Evolutionary mechanisms underlying adaptations; the relationships among theoretical population biology, developmental biology, functional morphology, and the fossil record, with some emphasis on quantitative models. Prerequisite: Biology 210 and consent of instructor; Biology 310 and a course in calculus recommended. 3 hours or $\frac{3}{4}$ unit.
333. **Vertebrate Embryology.** Development of the vertebrate body and its organs. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
334. **Experimental Cytology Laboratory.** Same as Botany 334. Introduction of cytological techniques, microscopic analysis of macromolecules, isotopic techniques, and autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.
335. **Ornithology.** Structure, functions, environmental relations, habits, life history, and identification of birds. Laboratory during first eight weeks and field trips during last eight weeks of the semester. Prerequisite: Biology 111 or equivalent. 3 hours or $\frac{1}{2}$ unit.

336. **Mammalogy.** Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. Prerequisite: Zoology 232. 4 hours or 1 unit.
337. **Ichthyology.** Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or ½ unit.
338. **Herpetology.** Classification, distribution, life history, and identification of reptiles and amphibians, particularly those of the United States. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or ½ unit. Offered in 1975-76 and in alternate years.
340. **Natural History of the Vertebrates.** Lecture: vertebrate adaptations; lab and field trips: identification, distribution, and life histories, with emphasis on vertebrates of Illinois. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
341. **Field Ecology.** Study of biotic communities, mammals, birds, reptiles, amphibia, fishes, and invertebrates in various sections of North America during spring vacation; outdoor camping and cooking; and transportation in University cars. Prerequisite: Credit or concurrent registration in one of the following: Zoology 304, 335, 336, 337, 338, 340, or 345; consent of instructor. 1 hour or ¼ unit. May be repeated for a maximum of 3 hours.
342. **Wildlife Management and Conservation.** Size and measurement of animal population; factors affecting reproduction and mortality; life history; and management policies for fishes, mammals, and birds. Prerequisite: Biology 111 or equivalent. 3 hours or ½ unit.
343. **Limnology.** Fresh water biology; study of the lake, pond, and river with emphasis on the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.
344. **Introduction to Primate Morphology and Behavior.** Same as Anthropology 343. Survey of primate social behavior and the classification, morphology, and distribution of living and extinct species; emphasis on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240 or Zoology 246, or consent of instructor. 2 hours, or ½ or 1 unit.
345. **Animal Ecology.** Study of the relationships between organisms and their environment; major emphasis on population dynamics and ecosystem functions and their significance to human populations. Prerequisite: Biology 212 or consent or instructor. 4 or 5 hours, or ¾ or 1 unit. Four hours or ¾ unit credit requires field work on six Saturdays; 5 hours or 1 unit requires field work on ten Saturdays, including one weekend field trip.
346. **Ethology.** Same as Anthropology 346 and Animal Science 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or ¾ unit.
347. **Ethology Laboratory.** Same as Anthropology 347 and Animal Science 347. Laboratory in ethology. Prerequisite: Zoology 346 and consent of instructor. 3 hours or ¾ unit.
348. **Physiological Basis of Behavior.** Physiological mechanisms underlying behavior as determined through comparative studies; emphasis on the invertebrates; and topics including the functional organization of nervous systems, neurosecretion and synaptic chemistry, sensory physiology, and integration. Prerequisite: Zoology 346 or Psychology 345; Physiology 301 or 302. 3 hours or ¾ units.
349. **Ecology and Evolution of Social Structure.** Evaluation of the interplay between social organizations and ecologic factors with emphasis on evolutionary mechanisms and consequences. Prerequisite: Zoology 346; Biology 310. 3 hours or ¾ unit.
350. **Behavior-Genetic Analysis.** Same as Anthropology 342 and Psychology 342. Concepts, methods, and problems in analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240 or Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or ¾ or 1 unit.
351. **Viruses, I.** Same as Microbiology 351 and Botany 351. Introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200,

- or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.
- 352. Viruses, II.** Same as Botany 352 and Microbiology 352. Extension of the principles developed in Zoology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Zoology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or $\frac{3}{4}$ unit.
- 359. Aquatic Ecology.** Same as Civil Engineering 347. Integrated study of the environmental factors affecting the composition and distribution of biota in lakes, rivers and estuaries; emphasis on the nature of the response of aquatic ecosystems to stress and practical means of aquatic resource management. Prerequisite: Credit or concurrent registration in Civil Engineering 346 or Zoology 343, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 361. Individual and Group Behavior of Honey Bees.** Same as Entomology 361 and Horticulture 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit.
- 367. Analysis of Development.** Advanced study of basic problems in developmental biology; major emphasis on interactions at molecular, fine structural, and cellular levels; the genetic and metabolic mechanisms by which these interactions are controlled in plants and animals; and critical examination of theories of differentiation in light of recent research. Lectures, discussions, outside readings, and student reports. Prerequisite: Biology 211 or Zoology 333; Biology 210; organic chemistry. 3 hours or $\frac{3}{4}$ unit.
- 369. Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, and Veterinary Medical Science 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environments; regulation of population; and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.
- 393. Laboratory in Primate Social Behavior.** Same as Anthropology 393 and Psychology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 402. Molecular Genetics: Chromosome Mechanics.** Same as Botany and Microbiology 402. Structure and behavior of chromosomes (including replication, repair, and complementation, recombination, and mutation); emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or equivalent. $\frac{3}{4}$ unit.
- 405. Molecular Genetics.** Same as Botany and Microbiology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, (including gene regulation, transcription, and translation). Prerequisite: Microbiology 330 or 316; mathematics through calculus, or consent of instructor. $\frac{3}{4}$ unit.
- 406. Physiology of Reproduction.** Same as Animal Science 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit.
- 407. Evolutionary Theory.** Genetic, systematic, ecological, and zoogeographical concepts as related to the processes of evolution. Prerequisite: One course in genetics; consent of instructor. 1 unit.
- 408. Laboratory Methods in Physiology of Reproduction.** Same as Animal Science 408. Combined credit in Animal Science 407 and Zoology 408 may not exceed 2 units. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.

412. **Advanced Endocrinology.** Same as Physiology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312; consent of instructor. ½ unit. May be repeated for a maximum of 2 units.
418. **Advanced Protozoology.** Advanced consideration of selected topics, with lectures, discussions and readings; emphasis on laboratory practice in modern methods and techniques of studying both free-living and parasitic protozoa; and collecting, culturing, and staining of representative forms. Prerequisite: Zoology 318 or equivalent. 1 unit. Offered in 1974-75 and in alternate years.
419. **Topics in Experimental Protozoology.** Consideration of the advantageous employment of protozoa in modern researches concerned with basic biological problems; selected experimental topics covered by lectures, demonstrations, discussions, reports, and readings. Prerequisite: Consent of instructor. ½ or 1 unit. Offered in 1974-75 and in alternate years.
420. **Experimental Invertebrate Zoology.** Study of current research problems and practice in the experimental methods used in the area of invertebrate zoology. Prerequisite: Zoology 320 or equivalent; consent of instructor. 1 unit.
421. **Cytogenetics.** Same as Botany 421. Chromosome theory: the structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210 or Microbiology 330, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
422. **Advanced Parasitology.** Advanced study of modern methods in helminthology. Prerequisite: Zoology 321 or equivalent. 1 unit.
425. **Experimental Parasitology.** Same as Veterinary Medical Science 425. Broadly based consideration of the relation of parasites to their hosts and to their environments, and of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Biochemistry 350; statistics recommended. 1 unit.
433. **Topics in Developmental Biology.** Study of initial differences in developing systems and interactions leading to more complex differences. May be elected in successive years. Prerequisite: Zoology 367. ¼ unit. Maximum credit for master's candidates, 1 unit; for doctoral candidates, 3 units.
441. **Advanced Comparative Physiology.** Same as Physiology 441. Seminar, lectures, student reports, and discussions. Prerequisite: Consent of instructor. ½ unit.
442. **Advanced Comparative Physiology Laboratory.** Same as Physiology 442. Laboratory experiments presenting comparative principles in osmotic and ionic regulation; respiration and metabolism; temperature regulation of animals; and physiology of circulatory systems, of muscle, of sense organs, and of nervous systems. Prerequisite: Physiology 402, 403, and 404; credit or concurrent registration in Zoology 441. 1 unit.
443. **Problems in Primate Behavior and Ecology.** Same as Anthropology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects; topics vary each semester. Prerequisite: Consent of instructor. ½ or 1 unit. May be repeated for additional credit.
444. **Concepts in Ethology.** Group discussion of problems such as stimulus filtering, spontaneity, and stereotyped motor patterns, with a new topic each semester. Prerequisite: Zoology 346. ½ unit.
445. **Seminar in Fish and Wildlife Ecology.** Modern ecological principles and concepts to specific problems in fisheries and wildlife. Prerequisite: Zoology 342 or 345, or equivalent. ½ unit. Offered in 1974-75 and in alternate years.
446. **Physiological Ecology.** Physiological adjustments and responses of organisms to their environment. 1 unit.
451. **Advanced Cellular Physiology.** Same as Physiology 451. Seminar, lectures, student reports, and discussions. Prerequisite: Consent of instructor. ½ unit.
467. **Experimental Embryology.** Prerequisite: Zoology 367. 1 unit.
490. **Individual Research.** For master's degree candidates who elect to write a research re-

port rather than a thesis. Prerequisite: Consent of adviser. $\frac{1}{2}$ to 3 units. No more than 3 units may be included in the master's degree program.

491. **Topics in Population Biology.** Seminar course devoted to discussion of problems in population biology, with a different topic each semester. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 4 units.
499. **Thesis Research.** 0 to 4 units.

LINGUISTICS

(Including Arabic, Hindi, Modern Greek, Modern Hebrew, Swahili, and Yoruba)

Head of Department: Professor B. B. Kachru

Department Office: 4088 Foreign Languages Building, Urbana

Arabic

201. **Elementary Arabic, I.** An introduction to Arabic in one of its standard national forms; includes conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Arabic, II.** Second term of spoken Arabic; includes conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 201. 5 hours.
203. **Elementary Spoken Arabic, I.** An introduction to spoken Arabic in one of its standard dialects; includes conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar. 5 hours.
204. **Elementary Spoken Arabic, II.** Continuation of Arabic 203, with introduction of more advanced grammar, and with an emphasis on achieving more fluency in spoken Arabic. Prerequisite: Arabic 203. 5 hours.
303. **Intermediate Arabic, I.** First term of second year of the Arabic language, with drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Arabic, II.** Concentration on ability to engage in reasonably fluent discourse in Arabic, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Arabic, I.** Reading selections from literary works; selections from political, social, historical, and economic writings. Prerequisite: Arabic 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Arabic, II.** Continuation of Arabic 305. Further reading in literary sources as well as in history, economics, and politics. Prerequisite: Arabic 305 or equivalent. 5 hours or 1 unit.
307. **Introduction to Arabic Literature, I.** Select readings in Arabic literature with emphasis on the novel and short story; lectures and discussions on the theory of literature and Arabic aesthetics. Prerequisite: Arabic 304. 3 hours or 1 unit.

Hindi

201. **Elementary Hindi, I.** An introduction to Hindi; includes conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Hindi, II.** Second term of spoken Hindi; includes conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 201. 5 hours.
301. **Intensive Hindi, I.** An intensive course on the Hindi language including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor; study of the formal grammar and the Devanagari script. 10 hours or 2 units.
302. **Intensive Hindi, II.** Includes drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; increasing study of the written language and more formal grammar; and concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 301 or equivalent, or consent of instructor. 10 hours or 2 units.
303. **Intermediate Hindi, I.** First term of second year of the Hindi language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Hindi, II.** Concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Hindi, I.** A course for advanced knowledge of spoken and written Hindi. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. Prerequisite: Hindi 304 or consent of instructor. 5 hours or 1 unit.
306. **Advanced Hindi, II.** A course for advanced knowledge of spoken and written Hindi with emphasis on modern Hindi literature and language. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. Prerequisite: Hindi 305 or consent of instructor. 5 hours or 1 unit.
307. **Advanced Hindi, III.** A course for detailed analysis of formal grammar of Hindi with concentration on readings from Hindi literature. Prerequisite: Hindi 306 or consent of instructor. 5 hours or 1 unit.
308. **Advanced Hindi, IV.** A survey of the history of Hindi literature and readings from different periods of Hindi literature. Prerequisite: Hindi 307 or consent of instructor. 5 hours or 1 unit.
309. **Readings in Hindi Literature in Translation.** Introduction to Hindi literature since 1400 A.D.; concentration on major works in poetry and prose available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit.
310. **Readings in Hindi Literature in English Translation.** Introduction to Hindi literature of the modern period; concentration on major works in poetry, prose, and novel available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit.

Linguistics

198. **Freshman Seminar.** A research-oriented survey of the fundamentals of general linguistics and the role of languages in culture and society; emphasis on South Asia. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Elements of Linguistics.** Same as Anthropology 200. An elementary survey of the methods used in descriptive and historical linguistic analysis, with application to languages usually taught in college. Prerequisite: One year of a foreign language or equivalent. 3 hours.
201. **Elements of Phonology.** Introduction to the formal description of phonological structure, including study of articulatory phonetics, the phonological feature framework, and fundamental concepts of generative phonological theory. Prerequisite: Credit or concurrent registration in Linguistics 200, or consent of instructor. 3 hours.
202. **Elements of Syntax.** Introduction to the types of syntactic and semantic phenomena found in natural language, with material drawn from a variety of languages; emphasis on the implications of such phenomena for linguistic theory; formalism and application of generative grammar. Prerequisite: Credit or concurrent registration in Linguistics 200, or consent of instructor. 3 hours.
220. **Language in African Culture and Society.** Introduction to the sociolinguistic context of Africa; special emphasis on the study of selected African languages for understanding the African cultural heritage; and a critical discussion on African oral literary tradition, language variety, language attitude, language standardization, and other linguistically relevant language problems. 3 hours.
225. **Elements of Psycholinguistics.** Introduction to the theory and methodology of psycholinguistics with emphasis on language acquisition and linguistic behavior. 3 hours.
300. **Introduction to Linguistics.** Same as Anthropology 300. Introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
301. **Introduction to General Phonetics.** Introduction to the main branches of general phonetics and phonological theory; emphasis on analysis of non-Western languages and research techniques. 3 hours or $\frac{1}{2}$ unit.
302. **Comparative Linguistics.** Introduction to the historical aspects of language. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or $\frac{1}{2}$ unit.
303. **Non-Western Linguistic Structures.** Intensive study of linguistic structure of a selected non-Western language. 3 hours or 1 unit. With consent of instructor, this course may be repeated for credit.
305. **Introduction to Applied Linguistics.** Same as English as a Second Language 305. Introduction to the applications of general linguistic theory to the specific fields of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign and second languages; practical assignment work. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Introduction to Mathematical Linguistics.** Same as Anthropology 307. Principles of set theory, logic and formal systems, group theory, and automata theory; introduction to the formal theory of grammars. Prerequisite: Linguistics 300. 3 hours or 1 unit.
308. **Comparative Grammar of Greek and Latin.** Same as Greek 308 and Latin 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or $\frac{3}{4}$ unit.
309. **Introduction to Indo-European Linguistics.** Introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction; principles of comparative phonology and introductory survey of morphology; and discussion of theories about the original home, culture, and society of the Indo-Europeans.

Prerequisite: Fulfillment of the language requirement of the College of Liberal Arts and Sciences. 3 hours or 1 unit.

310. **Topics in Indo-European Linguistics.** Principles of Indo-European morphology; paper and discussion on selected topics of Indo-European linguistics such as phonology, morphology, migrations, and antiquities. Prerequisite: Linguistics 309 or equivalent. 3 hours or 1 unit.
311. **The Structure of Greek and Latin.** Same as Greek 309 and Latin 309. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Greek 202 or Latin 202, or equivalent with the option of simultaneous enrollment; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Structure of the French Language.** Same as French 316. General survey of the linguistic structure of modern standard French including phonology, morphology, and syntax; emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or $\frac{3}{4}$ unit.
317. **Languages of the World.** Same as Anthropology 317. Survey of the main language families of the world from both genetic and typological points of view, with special reference to the theory of syntactic descriptions. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
320. **Introduction to African Linguistics.** Introduction to genetic and typological classification of the main language families of Africa; concentration on grammatical and phonological characteristics. Prerequisite: Linguistics 200 or 300; consent of instructor. 3 hours or 1 unit.
325. **Introduction to Psycholinguistics.** Same as Communications 325. Introductory survey of psychological and linguistic approaches to the study of communication. Credit is not given for both Psychology 325 and Linguistics 325. Prerequisite: Credit or concurrent registration in Linguistics 300. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Korean 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
338. **Philosophies of Language.** Same as Philosophy 338. Study of the development of philosophical problems about language and their treatment from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **History of Linguistics.** Survey of linguistic theories from ancient to modern times; special emphasis on comparative grammar and the development of structural linguistics; and extended discussion of at least one other period. Prerequisite: Linguistics 300 or equivalent. 3 hours or 1 unit.
345. **Tutorials in Asian Languages.** Same as Asian Studies 345. Tutorials at the elementary, intermediate, and advanced levels in special Asian languages not regularly offered are available with the consent of the Director of the Center for Asian Studies; may be repeated up to six semesters successively, but no more than 4 units of graduate credit may be accumulated and graduate credit is given only for work beyond the elementary level. Prerequisite: Consent of Director of the Center for Asian Studies. 5 hours or 1 unit.
350. **Sociolinguistics.** Same as English as a Second Language 350. Critical study of the sociologically oriented general linguistic theories; special reference to language varieties, language attitudes, language diversity, language standardization, linguistic geography, and language and political roles (language loyalty); emphasis on research methodology and techniques; and concentration on South Asia. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
360. **Introduction to South Asian Linguistics.** Introduction to genetic and typological classification of the main language families of South Asia; concentration on phonology and syntax. Prerequisite: Consent of instructor. 3 hours or 1 unit.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the

Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or ½ unit.

367. **Introduction to Germanic Linguistics.** Same as Germanic 367. Comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent; some knowledge of German desirable. 2 hours or ½ unit.
370. **Language, Culture, and Society.** Same as Anthropology 370 and Communications 370. Examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230 or one course in communications or linguistics, or consent of instructor. 3 hours, or ½ or 1 unit.
375. **Speech Science, I.** Same as Speech and Hearing Science 375 and Speech Communication 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms and to fundamental acoustics of speech. Prerequisite: Speech and Hearing Science 109 or 301, or consent of instructor. 4 hours or 1 unit.
376. **Speech Science, II.** Same as Speech and Hearing Science 376 and Speech Communication 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Linguistics 375. 4 hours or 1 unit.
380. **Introduction to Slavic Linguistics.** Same as Slavic 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or ¾ unit.
382. **Introduction to Sanskrit Linguistics, I.** The sounds and alphabet of Sanskrit; introduction to grammar, with drill and readings; and sandhi rules. Reading: Nala and Damayanti. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
383. **Introduction to Sanskrit Linguistics, II.** Further grammar and reading; consideration of Sanskrit from one or more of the following points of view: (a) comparative Indo-European linguistics, (b) Indology, (c) Paninian linguistics, (d) Western linguistic theories, and (e) transformational-generative grammar. Prerequisite: Linguistics 382. 3 hours or 1 unit.
387. **The Structure of English.** Critical evaluation of traditional and structuralist grammatical descriptions; introduction to transformational grammatical studies; detailed survey of a transformational syntax of English; and brief introduction to generative phonology and morphophonemic analysis of English, especially stress. 3 hours or ¾ unit.
388. **Linguistics in Language Learning, I.** Same as Rhetoric 388. Application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or ¾ unit.
389. **Linguistics in Language Learning, II.** Same as Rhetoric 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the applications of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or ¾ unit.
401. **Syntax.** Critique of traditional and contemporary theories of syntactic structure; systematic introduction to transformational grammar. Prerequisite: Linguistics 300 or equivalent. 1 unit.
402. **Phonology.** Examination of language-specific phonological problems with a view toward formulating a language-independent theory of phonology. Prerequisite: Linguistics 301 or consent of instructor. 1 unit.
403. **Seminar in Linguistic Analysis.** Discussion of advanced topics of current interest in descriptive linguistics. Prerequisite: Linguistics 401. 1 unit. May be repeated for credit with consent of instructor.
404. **Practicum.** Classroom- and homework-solving of assorted problems in syntactic and phonological analysis of many languages. Prerequisite: Linguistics 401 and 402. 1 unit.

405. **Seminar in Stylistics.** Seminar designed to evaluate and discuss earlier and current linguistically motivated stylistic theories; emphasis on the theoretical and methodological problems in application of linguistics to stylistic analysis of literary texts. Prerequisite: Linguistics 300 or 305; consent of instructor. 1 unit.
407. **Advanced Topics in Mathematical Linguistics.** The hierarchy of automata and the hierarchy of grammars; equivalence theorems and undecidability theorems; and recognition procedures. Prerequisite: Linguistics 307 or equivalent. 1 unit.
408. **Russian Phonology.** Same as Russian 408. The sound pattern of Russian in its synchronic and diachronic aspects. Prerequisite: Consent of instructor. 1 unit.
411. **Methods in Historical Linguistics.** Advanced analysis of genetic comparison and reconstruction, linguistic borrowing, linguistic geography, etymology, and related topics. Prerequisite: Linguistics 302 or 315. 1 unit.
412. **Research Seminar in Historical Linguistics.** Research work in etymology, linguistic geography, and historical syntax. Prerequisite: Linguistics 411 or consent of instructor. 1 unit.
419. **Contrastive Linguistics.** Same as English as a Second Language 419. Critical survey of contemporary linguistic models; special reference to their relevance in preparing contrastive analyses of languages; and detailed discussion on contrastive analysis of English and selected non-Western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. ½ or 1 unit.
420. **Linguistic Phonetics.** Principles of scientific description of the phonic aspect of language; distinctive features and phonetic alphabets; relations between phonetics and other linguistic levels; and inventory of speech sounds. Prerequisite: Linguistics 301 or equivalent. 1 unit.
421. **Seminar in Phonetic Theories.** Theories of speech production; motor theory and linguistic change; acoustical correlates of vocal-tract configurations; theories of speech perception; and a model of universal phonetics. Prerequisite: Linguistics 301 or equivalent. 1 unit.
424. **Developmental Psycholinguistics.** Same as Communications 424 and Psychology 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Communications 425 and Psychology 425. Critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic approaches, information-theory and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Communications 426 and Psychology 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course are expected to plan, execute, and report an original piece of research in this area during the course. Prerequisite: Linguistics 425; consent of instructor. ½ or 1 unit.
429. **Second Language Acquisition and Bilingualism.** Same as Psychology 429. Examination of the field from a psycholinguistic perspective; topics discussed include first versus second language acquisition; the nature of language aptitude and competence; methods of second language teaching; the nature of bilingualism; and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit.
441. **Syntax, II.** Advanced analysis and critique of syntactic descriptions, with special attention to implications for universal grammar. Prerequisite: Linguistics 401 or consent of instructor. 1 unit.
442. **Phonology, II.** Continuation of Linguistics 402. Prerequisite: Linguistics 402. 1 unit.
450. **Linguistics and the Study of Meaning.** Consideration of those aspects of meaning which are the concern of linguistic theory. Prerequisite: Linguistics 300. 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Portuguese, Romance Lin-

guistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Linguistics 362 or consent of instructor. 1 unit.

475. **Experimental Phonetics, I.** Same as Speech and Hearing Science 475. Theoretical consideration of speech as motor behavior; special reference to physiological investigations of normal respiration, phonation, and articulation; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
476. **Experimental Phonetics, II.** Same as Speech and Hearing Science 476. Theoretical consideration of speech as an acoustical phenomenon; special reference to acoustical investigations of voice and speech sounds; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
477. **Measurement of Speech, I.** Same as Speech and Hearing Science 477. Principles and methods of measuring speech action; special action recorders and transducers; techniques of analysis; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Linguistics 475. 1 unit.
478. **Measurement of Speech, II.** Same as Speech and Hearing Science 478. Principles and methods of measuring the acoustical phenomena of speech; oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Linguistics 476. 1 unit.
481. **Topics in Syntactic Theory.** Investigation of syntactic universals; recent developments in the theory of syntax. Prerequisite: Linguistics 317, 387, or 401; consent of instructor. 1 unit.
482. **Topics in Phonological Theory.** Continuation of Linguistics 402; special topics and individual papers assigned. Prerequisite: Linguistics 402 or equivalent. 1 unit.
490. **Special Topics in Linguistics.** Individual studies in the areas of linguistics not covered by regular course offerings. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.

Modern Greek

201. **Elementary Modern Greek, I.** An introduction to Modern Greek, in its spoken and written forms, including the elements of formal grammar. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Modern Greek, II.** Second term of spoken Modern Greek; formal grammar based on graded lesson materials; and work in written Greek. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Greek 201. 5 hours.
303. **Intermediate Modern Greek, I.** First term of second year of work in Modern Greek; drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; increasing study of the written language; and more formal grammar. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Modern Greek, II.** Continuation of Modern Greek 303. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 303 or equivalent. 5 hours or 1 unit.

Modern Hebrew

201. **Elementary Modern Hebrew, I.** Introduction to Hebrew; includes conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. Students are required to register for one hour weekly in the language laboratory. 5 hours.
202. **Elementary Modern Hebrew, II.** Continuation of Modern Hebrew 201, with introduction of more advanced grammar, and with emphasis on more fluency in speaking and reading. Prerequisite: Modern Hebrew 201. 5 hours.
303. **Intermediate Modern Hebrew, I.** First term of the second year of the Hebrew language, including drill for more advanced conversational fluency, increased study of the written language, and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Modern Hebrew, II.** Concentration on ability to engage in reasonable fluent discourse in Hebrew, comprehensive knowledge of formal grammar, and an ability to read ordinary written Hebrew. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Modern Hebrew, I.** A course for advanced knowledge of spoken and written standard Modern Hebrew. Prerequisite: Modern Hebrew 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Modern Hebrew, II.** A course for advanced knowledge of spoken and written standard Modern Hebrew with emphasis on Modern Hebrew literature and language. Prerequisite: Modern Hebrew 305 or equivalent. 5 hours or 1 unit.
307. **Advanced Modern Hebrew, III.** Selected readings from Modern Hebrew authors; emphasis on the novel and short story; lectures and discussions on Hebrew literature and aesthetics; and detailed analysis of the formal grammar of Hebrew. Prerequisite: Modern Hebrew 306 or consent of instructor. 5 hours or 1 unit.
308. **Advanced Modern Hebrew, IV.** Selected readings from modern Hebrew authors; special emphasis on the East European Revival literature; lectures and discussions on Hebrew literature and aesthetics; and detailed analysis of formal grammar of Hebrew. Prerequisite: Modern Hebrew 307 or consent of instructor. 5 hours or 1 unit.

Swahili

201. **Elementary Swahili, I.** Same as African Studies 201. Beginning spoken Swahili with minimum of formal grammar; conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.
202. **Elementary Swahili, II.** Same as African Studies 202. Second semester of spoken Swahili; more conversation with a native tutor; and further grammar. Prerequisite: Swahili 201. 5 hours.
303. **Intermediate Swahili, I.** Same as African Studies 303. Second-year Swahili with emphasis on developing conversational fluency; some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as African Studies 304. More of second-year Swahili with emphasis on conversational fluency; some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.

Yoruba

201. **Elementary Yoruba, I.** Same as African Studies 205. An introduction to Yoruba; includes conversation with a native Yoruba-speaking tutor under the direction of a lin-

guist-instructor, and essentials of formal grammar. All students are required to register for three hours per week in the language laboratory. 5 hours.

202. **Elementary Yoruba, II.** Same as African Studies 206. Second term of spoken Yoruba; includes conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; and further formal grammar based on conversational materials. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 201 or consent of instructor. 5 hours.
303. **Intermediate Yoruba, I.** Same as African Studies 307. Continued study of Yoruban grammar with emphasis on developing conversational fluency; readings on Yoruban culture and current affairs. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 202 or consent of instructor. 5 hours or 1 unit.
304. **Intermediate Yoruba, II.** Same as African Studies 308. Concentration on attaining conversational fluency; further readings in Yoruban newspapers and magazines and simpler portions from contemporary Yoruban plays and novels. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 303 or consent of instructor. 5 hours or 1 unit.

MATHEMATICS

Head of Department: Professor P. T. Bateman

Department Office: 273 Altgeld Hall, Urbana

101. **Basic Mathematics.** Introduction to algebra, designed for the Educational Opportunities Program; topics in arithmetic, measurement, and elementary geometry and algebra. 4 hours.
104. **Elements of Algebra and Trigonometry.** For premedical students and students in the curriculum preparatory to the teaching of biology who have entered with only one unit of high school algebra and who need credit in trigonometry as a prerequisite to physics. Students who enter with one and one-half units of algebra must take Mathematics 114. Credit in Mathematics 104 involves duplication of credit with Mathematics 111, 114, and 118, and does not serve as a prerequisite for Mathematics 122 or 123. Prerequisite: High school algebra, one unit; high school plane geometry, one unit. 3 hours.
111. **Algebra.** Students having one and one-half or more units of high school algebra may not take this course unless they have the approval of their college office. Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, one unit; high school plane geometry, one unit. 5 hours.
112. **College Algebra.** Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, one and one-half units; high school plane geometry, one unit. 3 hours.
114. **Plane Trigonometry.** Prerequisite: Entrance algebra, one and one-half units, or concurrent registration in Mathematics 111; high school plane geometry, one unit. 2 hours.
118. **Introduction to Mathematics, I.** An elementary course for students whose major interests are not in engineering or the physical sciences; provides an overall view of mathematics; emphasizes ideas and concepts rather than routine drill; and includes concepts from the following areas: combinatorics, number theory, the real and rational number systems, topology, representation of numbers, and map coloring. Prerequisite: High school algebra, one unit; high school plane geometry, one unit; or equivalent. 3 hours.
119. **Introduction to Mathematics, II.** Continuation of Mathematics 118; includes concepts from the following areas: combinatorics, algebraic number theory, constructions, cardi-

- nal numbers, probability and statistics, analytic geometry, and calculus. Prerequisite: Mathematics 118. 3 hours.
120. **Calculus and Analytic Geometry.** First course in calculus and analytic geometry; basic techniques of differentiation and integration with applications, including curve tracing in the plane. Students with strong backgrounds in analytic geometry should normally enroll in Mathematics 135. Credit is not granted for Mathematics 120 or 135 and Mathematics 134. Prerequisite: Mathematics 111 or 112, and Mathematics 114, or an adequate placement test score. 5 hours.
124. **Introductory Analysis for Social Scientists, I.** An introduction to finite mathematics for students in the social sciences; introduces the student to the basic ideas of logic, set theory, and vectors and matrices with problems selected from the fields of social science and business. Prerequisite: Mathematics 111 or 112, or a passing grade on the Mathematics Placement Test. 3 hours.
130. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections; polar coordinates; parametric equations; vectors and partial derivatives; and first-order differential equations. Prerequisite: Mathematics 120. 5 hours.
131. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections; polar coordinates; and vectors. Prerequisite: Mathematics 120. 3 hours.
134. **Introductory Analysis for Social Scientists.** Introduction to the concepts of functions and relations and the basic ideas of the calculus. Credit is not granted for Mathematics 134 and Mathematics 120 or 135. Prerequisite: Mathematics 124. 4 hours.
135. **Calculus.** First course in calculus. Differentiation and integration; applications to curve-tracing, maxima and minima, area, and volume. Prerequisite: Completion of a thorough college-level course in plane and solid analytic geometry, or equivalent. 5 hours.
140. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Multiple integrals; infinite series; linear algebra; and linear differential equations. Prerequisite: Mathematics 130. 3 hours.
141. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Parametric equations; partial derivatives; multiple integrals; infinite series; linear algebra; and first-order and linear differential equations. Prerequisite: Mathematics 131. 5 hours.
145. **Calculus.** Second course in calculus. Further applications of derivatives and integrals; partial derivatives and vectors; multiple integrals; infinite series; and first-order and linear differential equations. Prerequisite: Mathematics 135. 5 hours.
149. **Honors Course in Mathematics.** Prerequisite: Concurrent registration in an honors section of Mathematics 120, 130, 131, 140, or 141; consent of the department. Enrollment is strictly limited to students with superior mathematical talents. 1 hour.
161. **Statistics.** Credit is not given for both Mathematics 161 and Economics 171 or Psychology 135. Prerequisite: Mathematics 111 or 112; sophomore standing. 3 hours.
190. **Calculus Computational Laboratory, I.** Introduction to "BASIC" and interactive programming; laboratory treatment of computational aspects of calculus including limits of sequences, derivatives, and approximation methods. Prerequisite: Credit or concurrent registration in Mathematics 120, 134, or 135, or equivalent. 1 hour.
191. **Calculus Computational Laboratory, II.** Continuation of Mathematics 190; topics include continued fractions; the number e ; the maximum problem; symbolic and numerical methods in differentiation and integration; and curve plotting. Prerequisite: Mathematics 190 or consent of instructor; credit or concurrent registration in Mathematics 130, 131, or 145, or equivalent. 1 hour.
192. **Calculus Computational Laboratory, III.** Continuation of Mathematics 191; topics include vectors and arrays in "BASIC"; linear algebra, and numerical and graphical methods of differential equations. Prerequisite: Mathematics 191 or consent of instructor;

credit or concurrent registration in Mathematics 140, 141 or 145, or equivalent. 1 hour.

198. **Freshman Seminar.** Guides the student in the study of selected topics not considered in standard courses. Prerequisite: Enrollment in the mathematics honors program; consent of department. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
202. **Mathematics for Elementary Teachers.** A systematic presentation of elementary mathematics for juniors and seniors who are preparing to teach in elementary schools. Topics include decimal numerals, number systems, sets, and introductory algebra. A simultaneous development of teaching methods and materials may be included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Junior standing in elementary education. 5 hours.
203. **Mathematics for Elementary Teachers.** Continuation of Mathematics 202. Topics include measurement, metric and nonmetric geometry, algebra, sets, and introduction to trigonometry, statistics, and probability. A simultaneous development of teaching methods and materials is also included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Mathematics 202 or consent of instructor. 3 hours.
249. **Honors Course in Mathematics.** Prerequisite: Concurrent registration in designated honors sections of certain advanced undergraduate mathematics courses. 1 hour.
263. **Statistics in Engineering and the Physical Sciences.** A first course in the use of statistical methods for interpreting the results of experiments; emphasis on applications to engineering and the physical sciences. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours.
287. **Introduction to Numerical Analysis.** Same as Computer Science 287. Introduction to the principles and techniques of numerical mathematics for students in the physical sciences; round-off error analysis; the approximation of functions, derivatives, and integrals; and the numerical solution of nonlinear equations, ordinary differential equations, and systems of linear equations. The computer is used extensively and a term project is assigned. Prerequisite: A basic computer science programming course; one year of calculus. 3 hours.
291. **Thesis and Reading Course, I.** Prerequisite: Mathematics 347 with grade of "B" or better, or consent of mathematics honors committee. 2 hours.
292. **Thesis and Reading Course, II.** Prerequisite: Mathematics 347 with grade of "B" or better, or consent of mathematics honors committee. 2 hours.
299. **Intermediate Seminar.** Guides the student to construct a coherent mathematical system by solution of nonroutine problems; subject matter varies with the instructor. Prerequisite: Enrollment in mathematics honors program; consent of department. 3 hours.
300. **The Theory of Sets and the Real Number System.** Elementary naive set theory and the development of the integers, the rational numbers, and the real numbers; principal emphasis on the mathematical needs of the secondary school teacher. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
301. **Fundamental Concepts of Algebra.** Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
302. **Topics on Geometry.** Historical development of geometry; includes tacit assumptions made by Euclid, Euclid's Fifth Postulate and its equivalents; the discovery of non-Euclidean geometries; geometry as a mathematical structure; finite geometries; geometry as a study of invariants of set transformations; projective geometry; applications of group theory to geometry; and vector geometry. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
303. **Advanced Aspects of Euclidean Geometry.** Selected topics from geometry, for example circum-circle, the nine-point circle, theorems on centroid and ortho-center, the construction of regular figures, isometries in the plane and space, rotations and translations, fixed points, ordered and affine geometries, and geometry of inversive plane. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

305. **Teacher's Course.** Presents selected topics in mathematics that are related to the content of secondary school mathematics programs; provides background for enrichment topics for secondary school students; and may include, among others, the following topics: number systems, mathematical induction, number theory, probability, graph theory, Boolean algebras and their relation to computer design, ruler and compass constructions, and the geometry of complex numbers. Prerequisite: Mathematics 140, 141, or 145, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **Selected Mathematical Topics for Secondary School Teachers, I.** Deals with the teaching of the following topics in secondary school mathematics: symbolism and numbers; directed numbers; variables; equations (linear, quadratic, and systems); sets; graphs; bases of enumeration; functions; and critical examination of these topics. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
307. **Selected Mathematical Topics for Secondary School Teachers, II.** Deals with the teaching of the following topics in high school mathematics: variables in geometry; logical analysis of geometrical propositions; equivalence relations in geometry including congruence and similarity; geometry in the coordinate plane; cosine and sine as real valued functions of real arguments; a comparison of these functions with those ordinarily taught in the high school; symmetry; periodicity; evenness and oddness; and exponential and logarithmic functions. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Theory of Interest.** A study of compound interest and annuities; applications to problems in finance. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
311. **Advanced Algebra.** For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
312. **Advanced Algebra.** For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
313. **Combinatorial Mathematics.** Same as Computer Science 313. Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, and block designs. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
314. **Introduction to Set Theory and Mathematical Logic.** Supplies the set-theoretic and logical preliminaries for graduate work in mathematics; includes sets, relations, and mappings; the notions of constant and variable; the integers; cardinal and ordinal numbers; Zorn's lemma; the real numbers; informal account of the propositional calculus and first-order functional calculus; and informal account of various axiomatic theories. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
315. **Linear Transformations and Matrices.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
317. **Introduction to Abstract Algebra.** An introductory course in abstract algebra; includes modular arithmetic, permutations, group theory through the isomorphism theorems, ring theory through the notions of prime and maximal ideals, and additional topics such as unique factorization domains and classification of groups of small order. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
318. **Introduction to Linear Algebra.** Abstract approach emphasizing concept of linear transformation; topics include linear equations, vector spaces, linear transformation, matrices, determinants, invariant subspaces, direct sum decompositions, canonical forms, inner product spaces, and bilinear forms. Prerequisite: Mathematics 317. 3 hours or 1 unit.
319. **Applied Modern Algebra.** Sets and functions; binary relations and graphs; applications to finite-state machines and formal languages; Boolean algebras; and emphasis on the underlying mathematical structure. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.

323. **The Elements of Geometry and Topology, I.** Introduction to geometrical techniques relevant to topology and differential geometry; curves from four viewpoints: topology, differential geometry, combinatorics, and algebraic geometry; and local differential geometry of surfaces. Prerequisite: Mathematics 343. 3 hours or 1 unit.
324. **The Elements of Geometry and Topology, II.** Continuation of Mathematics 323. Three viewpoints of surfaces are studied and interrelated: topology, differential geometry, and combinatorics (algebraic topology). Prerequisite: Mathematics 323. 3 hours or 1 unit.
327. **Introduction to Projective Geometry, I.** Prerequisite: Mathematics 315 or consent of instructor. 3 hours or 1 unit.
332. **Introduction to Set Theory and Topology.** Informal set theory, cardinal and ordinal numbers, and axiom of choice; topology of metric spaces and introduction to general topological spaces. Prerequisite: Credit or concurrent registration in Mathematics 347. 3 hours or 1 unit.
341. **Differential Equations.** A basic course in ordinary differential equations; topics include existence and uniqueness of solutions and the general theory of linear differential equations; treatment is more rigorous than that given in Mathematics 345 but not as rigorous as that given in Mathematics 349. Credit is not given for both Mathematics 341 and 345 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
342. **Differential Equations.** Deals with the theory of Fourier series and applications to solving partial differential equations. Prerequisite: Mathematics 341 or 349. 3 hours or 1 unit.
343. **Advanced Calculus.** Introductory study of vector calculus and functions of several variables; topics include directional derivatives; Jacobians; change of variables in multiple integrals; maxima and minima; line and surface integrals; theorems of Gauss, Green, and Stokes; infinite series; and uniform convergence. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
344. **Elementary Real Analysis.** Careful treatment of the theoretical aspects of the calculus of functions of a real variable; topics include the real number system, limits, continuity, derivatives, and the Riemann integral. Credit is not given for both Mathematics 344 and 347. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
345. **Differential Equations and Orthogonal Functions.** Intended for engineering students and others who require a working knowledge of differential equations. Credit is not given for both Mathematics 345 and 341 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
346. **Complex Variables and Applications.** For students who desire a working knowledge of complex variables; covers the standard topics; and gives an introduction to integration by residues, the argument principle, conformal maps, Laplace transforms, and potential fields. Students desiring a systematic development of the foundations of the subject should take Mathematics 348. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.
347. **Introduction to Higher Analysis: Real Variables.** Careful development of elementary real analysis including such topics as completeness property of the real number system; basic topological properties of n -dimensional space; convergence of numerical sequences and series of functions; properties of continuous functions; and basic theorems concerning differentiation and Riemann integration. Credit is not given for both Mathematics 344 and 347. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.
348. **Introduction to Higher Analysis: Complex Variables.** For students who desire a rigorous introduction to the theory of functions of a complex variable; topics include Cauchy's theorem, the residue theorem, the maximum modulus theorem, Laurent series, the fundamental theorem of algebra, and the argument principle. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 347. 3 hours or 1 unit.

349. **Differential Equations and Orthogonal Functions.** An honors course that presents a more rigorous treatment of the subject than that given in Mathematics 341 and 345. Credit is not given for both Mathematics 349 and 341 or 345. Prerequisite: A grade of "B" or higher in Mathematics 347; and, for undergraduates, concurrent registration in Mathematics 249. 3 hours or 1 unit.
351. **Topics in Applied Mathematics.** A survey course in applied mathematics for secondary school mathematics teachers; deals with topics in the application of matrices to physical and social sciences, and in the applications of Boolean algebra and game theory. Prerequisite: Consent of instructor. 3 hours or 1 unit.
352. **Multivariate Real Analysis.** Rigorous treatment of the calculus of functions of several real variables; topics covered include differentials, maxima and minima, Lagrange multipliers, transformation of multiple integrals, Jacobian's implicit function theorems, line and surface integrals, Stokes' theorem, and vector analysis. Prerequisite: Mathematics 347. 3 hours or 1 unit.
353. **Elementary Theory of Numbers.** Topics covered include divisibility, primes, congruences, quadratic reciprocity, and Farey sequences. The course objectives are to familiarize students with mathematical proofs and to prepare them for further work in algebra and number theory. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
354. **Theory of Algebraic Numbers.** Topics include Gaussian integers and primes, polynomials, divisibility, algebraic integers, arithmetic in algebraic number fields, ideals, class numbers, and units. Prerequisite: Mathematics 317 or 353. 3 hours or 1 unit.
357. **Mathematical Models in the Social Sciences.** Use of many models drawn from the social sciences to motivate, illustrate, and give a unified development of topics in the following areas: linear algebra, graph theory, Markov chains, and linear and nonlinear systems of difference equations. Prerequisite: Mathematics 134 or equivalent. 3 hours or 1 unit.
361. **Theory of Probability.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
362. **Finite Differences.** Finite differences, finite integration, interpolation, and difference equations. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
363. **Advanced Statistics.** Probability and statistical inference. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
364. **Advanced Statistics.** Continuation of Mathematics 363. Prerequisite: Mathematics 363. 3 hours or 1 unit.
365. **Analysis of Variance.** Estimation and hypotheses testing in linear models; one-, two-, and higher-way layouts; incomplete layouts; analysis of covariance; and random effects models and mixed models. Prerequisite: Credit or concurrent registration in Mathematics 315 and 364. 3 hours or 1 unit.
366. **Theory of Probability.** Continuation of Mathematics 361. Topics covered may include random walks, Markov chains, branching processes, birth and death processes, and theory of queues. Prerequisite: Mathematics 361 or 363. 3 hours or 1 unit.
367. **Computer Application to Problems in Mathematics.** Same as Computer Science 367. Discussion of many problems which can be formulated mathematically and lend themselves to computer solution; problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; and game playing and decision problems. Prerequisite: Junior standing; Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
368. **Topics in Applied Statistics.** Formulation and analysis of mathematical models for random phenomena; student participation in statistical consulting; and instruction in statistical techniques as required. Prerequisite: Mathematics 363 or consent of instructor. 3 hours or 1 unit. May be taken for credit more than once with consent of instructor.

369. **Probability Theory.** Qualifies the student to study Mathematics 370 and, subsequently, the graduate courses in mathematical statistics. Starting from first principles, it covers characteristic functions, laws of large numbers, central limit theorems, and strong convergence. No measure theory is needed or used in this course. Prerequisite: Mathematics 347. 3 hours or 1 unit.
370. **Statistical Inference.** Basic course in mathematical statistics and prerequisite to all graduate courses on the subject; starts from the first principles and examines critically the bases of statistical inference. Although it is not a course in statistical techniques, graduates of the course will be able to read the literature of statistical techniques. Prerequisite: Mathematics 369 or 451. 3 hours or 1 unit.
371. **Actuarial Theory.** Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
372. **Actuarial Theory.** Prerequisite: Mathematics 371. 3 hours or 1 unit.
375. **Automatic and Formal Languages, I.** Same as Computer Science 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; and Post's correspondence problem and its application to context-free languages. Prerequisite: Computer Science 319 or consent of instructor. 3 hours or 1 unit.
376. **Automata and Formal Languages, II.** Continuation of Mathematics 375. Context sensitive languages and linear bounded automata; operations on languages, closure properties, and abstract families of languages; miscellaneous unsolvable problems; time-and-tape bounded Turing machines; and other topics chosen by the instructor. Prerequisite: Mathematics 375. 3 hours or 1 unit.
377. **Recursive Functions.** Computable functions; Turing computability; recursively enumerable sets; the halting problem; Rice's theorem; recursion theorem; and example of a priority argument. Prerequisite: Mathematics 375 or 314 or 317. 3 hours or 1 unit.
379. **Numerical Analysis, I.** Same as Computer Science 379. Careful study of solutions of nonlinear equations, numerical integration, interpolation, and approximation; development of selected algorithms for numerical solution on computers. Prerequisite: Mathematics 343 or Computer Science 287, or consent of instructor. 3 hours or 1 unit.
380. **Numerical Analysis, II.** Same as Computer Science 380. Algorithms for and the theory of the numerical solution of initial value and boundary value problems for differential equations are covered. This material will lead to a discussion of numerical methods for linear algebra and eigenvalue problems. Prerequisite: Computer Science 287 or Mathematics 287; Mathematics 343. 3 hours or 1 unit.
381. **Vector and Tensor Analysis.** Prerequisite: Mathematics 343 or equivalent, or consent of instructor. 3 hours or 1 unit.
382. **Vector, Tensor, and Matrix Methods in Applied Mathematics.** Prerequisite: Mathematics 381 or consent of instructor. 3 hours or 1 unit.
383. **Linear Programming.** Same as Computer Science 383. Systems of linear inequalities, the standard canonical and general linear problems, and simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
386. **Laplace Transforms.** Basic operation rules of Laplace transforms through the complex-inversion theorem; applications to solutions of initial and boundary value problems in differential equations; and evaluation of Cauchy integrals. Other types of transforms are considered and used for solving differential equations. Prerequisite: Mathematics 343. 3 hours or 1 unit.
388. **Mathematical Methods in Engineering and Science.** Prerequisite: Mathematics 343. 3 hours or 1 unit.
389. **Combinatorial Computing.** Same as Computer Science 389. Computational aspects of algorithms for solving combinatorial problems; topics include counting and enumeration, sorting, searching, and computational problems in graph theory and algebra. Prerequisite: Mathematics 315 or equivalent, and Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.

390. **Introduction to Optimization.** Same as Electrical Engineering 390. Basic theory and methods for the solution of optimization problems; iterative techniques for unconstrained minimization; and introductory presentation of linear and nonlinear programming with engineering applications. Prerequisite: Computer Science 101 or Mathematics 343, or consent of instructor. 3 hours or 1 unit.
391. **Switching Theory.** Same as Computer Science 391 and Electrical Engineering 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Electrical Engineering 392 and Computer Science 392. Synchronous machines: state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines: state assignment, hazards, and interacting machines. Prerequisite: Mathematics, Electrical Engineering, or Computer Science 391. 3 hours or 1 unit.
400. **General Seminar.** General seminar required of all graduate students who have passed the departmental written qualifying examination for the Ph.D. 0 credit.
401. **Second Course in Abstract Algebra, I.** Isomorphism theorems for groups; solvability of p -groups; simplicity of the alternating group on 5 letters; Sylow theorems and Jordan-Hölder theorem; principal ideal domains; Gauss' lemma; Eisenstein's criterion; fundamental theorem of Galois theory; finite fields; cyclotomic fields; and solvability of equations by radicals. Prerequisite: Mathematics 317 and 318. 1 unit.
402. **Second Course in Abstract Algebra, II.** Modules; Hilbert basis theorem; Krull-Schmidt theorem; Wedderburn theorem on semisimple rings; finitely generated modules over principal ideal domains, with applications to abelian groups and canonical forms for matrices; categories and functors; tensor products; and bilinear and quadratic forms. Prerequisite: Mathematics 401. 1 unit.
403. **Theory of Rings.** Ideal theory in commutative rings; structure of noncommutative rings. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
404. **Group Theory.** Structure of groups, derived groups, nilpotence and solvability, and extensions and products. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
405. **Algebraic Number Theory.** Further development of the theory of fields covering topics from valuation theory, ideal theory, units in algebraic number fields, ramification, function fields, and local class field theory. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
406. **Homological Algebra.** Definition and properties of the functors Ext and Tor ; projective, injective, and flat modules; group extensions; dimensions of rings, and Hilbert theorem on syzygies. Prerequisite: Mathematics 402 or equivalent. 1 unit.
407. **Group Representation Theory.** Representation of groups by linear transformations, group algebras, character theory, and modular representations. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
408. **Lie Algebras.** Examples of Lie algebras (low dimensions, Lie algebras of Lie groups, free algebras, and universal enveloping algebra); Poincaré-Birkhoff-Witt theorem; nilpotent and solvable algebras; Cartan subalgebras; structure of semisimple algebras; real forms; and representations. Prerequisite: Mathematics 401; credit or concurrent registration in Mathematics 402. 1 unit.
410. **Logical Foundations of Mathematics.** Development of the predicate calculus of first order as a framework for metamathematical investigations; consideration of the completeness and incompleteness theorems of Gödel. Prerequisite: Mathematics 314 or 317, or consent of instructor. 1 unit.
411. **Model Theory.** Elements of model theory, including Lowenheim-Skolem theorems, categoricity, ultraproducts, and applications to algebra; decidability theory using both model theoretic methods and elimination of quantifiers. Prerequisite: Mathematics 410. 1 unit.
412. **Recursive Function Theory.** Introductions to recursive functions; study of properties of recursive and recursively enumerable sets; degrees of unsolvability; and the implica-

- tions of the Church-Turing thesis. Prerequisite: Mathematics 410 or consent of instructor. 1 unit.
- 413. Set Theory.** Zermelo-Fraenkel axiomatic set theory; consideration of basic concepts in set theory such as ordinal, cardinal, and rank. Prerequisite: Mathematics 410. 1 unit.
- 414. Advanced Topics in Logic.** Prerequisite: Mathematics 410; consent of instructor. 1 unit.
- 415. Advanced Topics in the Theory of Groups.** Prerequisite: Consent of instructor. 1 unit.
- 416. Advanced Topics in Abstract Algebra.** Prerequisite: Consent of instructor. 1 unit.
- 417. Category Theory.** Categorical structure of mathematics; categories, functors, and natural transformations; limits, representable functors, and functor categories; adjoint functor theorems and Kan extensions; algebraic theories and tripleable categories; and numerous examples from algebra, topology, and analysis. Prerequisite: Credit or concurrent registration in Mathematics 402 and 435. 1 unit.
- 418. Graph Theory.** Structure of graphs; planarity and colorability of graphs; matrices associated with a graph; and automorphism group of a graph. Prerequisite: Mathematics 313, 317, or 319, or equivalent. 1 unit.
- 422. Algebraic Geometry.** Prerequisite: Mathematics 328. 1 unit.
- 423. Differentiable Manifolds.** Definition and properties of differentiable manifolds and maps, introducing vector fields, tangent bundles, differential forms, exterior derivatives, and foliations. Prerequisite: Mathematics 323 or 381, or consent of instructor. 1 unit.
- 424. Riemannian Geometry.** Local and global properties of Riemannian manifolds. Prerequisite: Mathematics 423. 1 unit.
- 425. Linear Analysis on Manifolds, I.** Study of topological invariants of differentiable and complex manifolds. Prerequisite: Mathematics 423 and 431, or consent of instructor. 1 unit.
- 426. Linear Analysis on Manifolds, II.** Continuation of Mathematics 425. Prerequisite: Mathematics 425. 1 unit.
- 427. Lie Groups.** Study of groups which are also differentiable manifolds. Prerequisite: Mathematics 423. 1 unit.
- 428. Topics in Geometry.** Prerequisite: Consent of instructor. 1 unit.
- 430. Elementary Geometry from a Modern Viewpoint.** Designed for secondary school teachers of mathematics; primary purpose is to discuss critically the logical structure and content of Euclidean geometry from the modern point of view; and consideration is given to the historical development of the modern approach. Prerequisite: One year of experience in the teaching of high school mathematics; consent of instructor. 1 unit.
- 431. Algebraic Topology, I.** Homological algebra techniques, simplicial and singular homology, fundamental group and covering spaces, and applications. Prerequisite: Mathematics 318 and 332; concurrent registration in Mathematics 401 or consent of instructor. 1 unit.
- 432. Algebraic Topology, II.** Continuation of Mathematics 431. Axiomatic homology theory, fibrations and cofibrations, CW-complexes, cohomology products, and other topics. Prerequisite: Mathematics 431; concurrent registration in Mathematics 402. 1 unit.
- 433. Fiber Spaces and Characteristic Classes.** Continuation of Mathematics 432. Study of fiber bundles and their associated characteristic classes; applications to geometric problems. Prerequisite: Mathematics 432. 1 unit.
- 434. Polyhedral Topology.** Topology in the piecewise linear category. Prerequisite: Mathematics 431 and 435. 1 unit.
- 435. General Topology, I.** Study of topological spaces and maps, including Cartesian products, identifications, connectedness, compactness, uniform spaces, and function space. Prerequisite: Mathematics 332 or consent of instructor. 1 unit.
- 436. General Topology, II.** Continuation of Mathematics 435. Prerequisite: Mathematics 435. 1 unit.
- 438. Topics in Topology.** Prerequisite: Consent of instructor. 1 unit.
- 439. Seminar in Topology.** Prerequisite: Consent of instructor. 1 unit.

440. **Theory of Functions of a Complex Variable, I.** Topics include the Cauchy theory, harmonic functions, entire and meromorphic functions, and the Riemann mapping theorem. Prerequisite: Mathematics 346 and 347, or Mathematics 348. 1 unit.
441. **Real Analysis, I.** Lebesgue measure on the real line; integration and differentiation of real valued functions of a real variable; and additional topics at discretion of instructor. Prerequisite: Mathematics 347 or equivalent. 1 unit.
442. **Real Analysis, II.** Abstract measure theory; integration on general measure spaces; and introduction to functional analysis. Prerequisite: Mathematics 441. 1 unit.
443. **Ordinary Differential Equations.** Existence, uniqueness, and continuation of solutions; topics selected from the following: the theory of linear differential operators, Sturm-Liouville theory, stability theory, and qualitative theory of differential equations. Prerequisite: Mathematics 347; a first course in ordinary differential equations. 1 unit.
444. **Partial Differential Equations.** Prerequisite: Consent of instructor. 1 unit.
445. **Theory of Functions of a Complex Variable, II.** Continuation of Mathematics 440. Topics include subharmonic functions, Nevanlinna theory, analytic continuation and Riemann surfaces, and univalent functions. Prerequisite: Mathematics 440. 1 unit.
446. **Hilbert Space.** Geometrical properties of Hilbert spaces; linear operators; and the spectral theory for self adjoint and related operators. Prerequisite: Mathematics 442. 1 unit.
447. **Banach Spaces.** Geometrical properties of Banach spaces; bounded linear operators; applications to analysis; and linear topological spaces. Prerequisite: Mathematics 442. 1 unit.
448. **Harmonic Analysis.** Locally compact groups; Haar measure; Fourier analysis; and Tauberian theorems. Prerequisite: Mathematics 442. 1 unit.
449. **Normed Rings.** Properties of normed rings; representation as rings of continuous functions or rings of bounded operators; and applications to spectral theory, harmonic analysis, etc. Prerequisite: Mathematics 318; Mathematics 446 or 447. 1 unit.
450. **Ordered Spaces.** Study of ordered topological vector spaces and vector lattices and positive operators. Prerequisite: Mathematics 442 and 447. 1 unit.
451. **Theory of Probability.** Prerequisite: Mathematics 442. 1 unit.
452. **Theory of Probability.** Prerequisite: Mathematics 451. 1 unit.
453. **Analytic Theory of Numbers, I.** Problems in number theory treated by methods of analysis; topics chosen from prime number theory, Riemann zeta function, sieve methods, diophantine approximation, metric theory, partitions, lattice points, Waring's problem, and asymptotic properties of arithmetrical functions. Prerequisite: Mathematics 317 or 348. 1 unit.
454. **Analytic Theory of Numbers, II.** Continuation of Mathematics 453. Prerequisite: Mathematics 453. 1 unit.
455. **Mathematical Methods of Physics.** Introduction to inner product spaces, linear operators, and Schwartz distribution theory; Green's functions for ordinary differential equations; and integral equations: Hilbert-Schmidt theory and Sturm-Liouville theory. Prerequisite: Mathematics 343 and 346. 1 unit.
456. **Mathematical Methods of Physics.** Calculus of variations: Euler-Lagrange theory, Rayleigh-Ritz method, and Dirichlet principle; integral transform methods and separation of variables; and approximation methods: finite differences, Galerkin's method, and asymptotic expansions. Prerequisite: Mathematics 455 or consent of instructor. 1 unit.
457. **Advanced Numerical Analysis.** Same as Computer Science 457. Ordinary differential equations: existence theory of Picard, one-step and multistep methods, discretization error, convergence, stability, and boundary value problems; integral equations. Prerequisite: Mathematics 380 or Computer Science 380, or consent of instructor. 1 unit.
458. **Topics in Numerical Analysis.** Same as Computer Science 458. The numerical solution of initial and boundary value problems for partial differential equations; topics include the approximation of differential operators by difference operators, the solution of large

systems of linear equations by iterative methods, and discussion of convergence and numerical stability. Prerequisite: Consent of instructor. 1 unit. May be repeated.

460. **Relativity and Cosmology.** Same as Astronomy 424 and Physics 424. Elements of tensor calculus and Riemannian geometry; special relativity; Lorentz transformations; equivalence of mass and energy; general relativity and the gravitational field of the sun; and galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit.
461. **Applied Stochastic Processes.** Introduction to topics such as spectral analysis, filtering theory, and prediction theory of stationary processes; Markov chains and Markov processes. Prerequisite: Mathematics 346 and 347. 1 unit.
463. **Information Theory.** Same as Computer Science 463 and Electrical Engineering 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361. 1 unit.
465. **Topics in Automata Theory.** Same as Computer Science 465 and Electrical Engineering 465. Prerequisite: Mathematics 392 or consent of instructor. 1 unit.
466. **Topics in Ordinary Differential Equations.** Introduction to current research in such areas as stability and asymptotic behavior of solutions; topological dynamics; numerical methods; and boundary value problems and spectral theory of differential operators. Prerequisite: Consent of instructor. 1 unit.
468. **Topics in Analysis.** Prerequisite: Consent of instructor. 1 unit.
469. **Seminar in Analysis.** Prerequisite: Consent of instructor. 1 unit.
470. **Statistical Decision Functions.** Statistics from the point of view of decision making; introduction to the theory of games; minimax and other decision functions; techniques for determining optimal decision functions; and applications to nonsequential and sequential decision making in practice. Prerequisite: Consent of instructor. 1 unit.
473. **The Theory of Testing Hypotheses.** Methods of constructing statistical tests which have optimum properties in small samples; the principles of invariance, unbiasedness, and similarity; and most stringent tests and minimax tests. Prerequisite: Consent of instructor. 1 unit.
474. **The Theory of Estimation.** Methods of constructing uniformly minimum variance unbiased estimates; minimax estimation; and estimation by confidence sets. Prerequisite: Consent of instructor. 1 unit.
478. **Topics in Statistics.** Prerequisite: Consent of instructor. 1 unit.
487. **Theory of Approximation.** Same as Computer Science 487. General approximation theory in normed linear spaces; primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Chebyshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants as approximants; and use of approximations in computing. Prerequisite: Mathematics 318 and 348, or consent of instructor. 1 unit.
488. **Topics in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
489. **Seminar in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
490. **Reading Course.** Prerequisite: Consent of instructor. 1 to 2 units.
499. **Thesis Research.** Prerequisite: Consent of instructor. 0 to 4 units.

MECHANICAL AND INDUSTRIAL ENGINEERING

Head of Department: Professor H. H. Korst

Department Office: 144 Mechanical Engineering Building, Urbana

Industrial Engineering

199. **Undergraduate Open Seminar.** 0 to 9 hours.
230. **Labor Relations.** The individual and his coordination, orientation, and maintenance in the group and in the business organization; the service, functions, regulations, union aspects, wage-price structure, and public considerations affecting labor-management relationships in various organizations. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.
232. **Methods-Time Analysis.** Principles of motion economy affecting the design of a product or service; the effective use of human effort as related to the tools and equipment used in manufacturing and commercial endeavors; reasons for time study and the principles of determining time standards; study of standard data and other specific types of micromotion standards; and applications of all phases of the studies to specific cases. Prerequisite: Mechanical Engineering 185 or equivalent; junior standing. 3 hours.
238. **Analysis of Data.** Nature of probabilistic models for observed data; discrete and continuous distribution function models; inferences on universe parameters based on sample values; and introduction to control charts, acceptance sampling, and measurement theory. Prerequisite: Completion of basic calculus. 3 hours.
282. **Process Planning and Economy in Manufacturing.** Principles of engineering economy and their applications to manufacturing problems; studies of typical manufacturing processes and their economic factors; and exercises in planning processes for maximum efficiency. Prerequisite: Mechanical Engineering 185 or equivalent; senior standing in engineering. Credit is not given for both Industrial Engineering 282 and 382. 3 hours.
286. **Operations Analysis.** The development and application of schematic and mathematical models for analysis and decision making relative to the task of coordinating manufacturing activities at optimum levels of economy and efficiency; stress on linear programming. Prerequisite: Industrial Engineering 232 and Mathematics 263, or consent of instructor. 3 hours.
287. **Job Evaluation and Wage Incentives.** Study of job evaluation techniques and wage incentive systems; problems of installing and maintaining job and position evaluation systems in industrial organizations. Prerequisite: Industrial Engineering 232 or equivalent; senior standing. 3 hours.
288. **Industrial Systems Analysis and Design.** Application of systems approach to the analysis of interacting industrial procedures; development of decision rules based on analytical treatment of system variables rather than by judgmental methods; and application of computers to the total synthesis and evaluation of operational procedures. Prerequisite: Credit or concurrent registration in Industrial Engineering 282 and 286. 3 hours.
290. **Senior Project Laboratory.** The planning, designing, execution, and evaluation of a technical project with the student assuming individual responsibility for the project. The responsibility for selection, development, and completion of the project is placed on the student with the advice and consent of the instructor. Prerequisite: Senior standing in industrial engineering. 2 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of industrial engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in industrial engineering; must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in industrial engineering

research. Prerequisite: Senior standing in industrial engineering; consent of head of department. 3 hours.

296. **Honors Project.** Same as Aeronautical and Astronautical Engineering, Electrical Engineering, and Mechanical Engineering 296. Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Same as Aeronautical and Astronautical Engineering, Electrical Engineering, and Mechanical Engineering 297. Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Industrial Engineering 293 or 296. 3 hours.
305. **Principles of Ergonomics.** Same as Physiology 305 and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Physiology 306 and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Industrial Engineering 305. 4 hours or 1 unit.
332. **Standard Time Systems.** The study of development, uses, and limitations of standard time data and predetermined time systems. Prerequisite: Industrial Engineering 232. 3 hours, or $\frac{3}{4}$ or 1 unit.
334. **Introduction to Reliability Engineering.** Same as General Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 238 or Mathematics 361, or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Industrial Quality Control.** Control charts for attributes and variables; modified control chart techniques; acceptance sampling for attributes and variables; relationship to design, production, and procurement; quality cost analysis; military standards practice; survey and reports of current quality literature; and management of quality programs. Prerequisite: Industrial Engineering 238 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **Design and Analysis of Industrial Experimentation.** Randomized blocks, t-tests, and factorial and fractional factorial designs; concepts of randomization, blocking, screening, and confounding; second-order designs, response surface methodology, and evolutionary operation; and introduction to mechanistic model building and nonlinear estimation. All topics are treated through engineering applications and case studies. Prerequisite: Industrial Engineering 238 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
350. **Manufacturing Process and Tool Design.** Study of and exercises in the design of manufacturing processes and tools for maximum efficiency; utilization of computer techniques in the design of manufacturing processes and tools. Prerequisite: Industrial Engineering 282 or undergraduate course in engineering economy. 3 hours, or $\frac{3}{4}$ or 1 unit.
355. **Numerical Control of Manufacturing Processes.** Study of numerical control systems, manufacturing processes, principles and practices basic to numerical control, and programming methodology for numerical control. Prerequisite: Mechanical Engineering

- 185 or consent of instructor; background in computer technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
357. **Safety Engineering.** Study of engineering principles applied to industrial accident prevention; safe plant layout; safety in maintenance; boilers and pressure vessels; design and application of machine guards; material handling and storage; hand and power tools; welding hazards; electrical hazards; flammable liquids and fire protection; industrial health engineering; and toxic materials. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
358. **Problems in Safety Engineering.** Extended and intensified study of specific safety problems; study of industrial safety procedures and methods of application; provides sound knowledge of accident prevention principles and applications for the student interested in entering the field of safety engineering in industry. Prerequisite: Industrial Engineering 357 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
382. **Design of Manufacturing Processing Systems.** Optimization in selection and arrangement of components of manufacturing process systems to produce parts to design specifications at lowest cost; system simulation and optimization with particular reference to computer utilization and recognition of risk and uncertainty. Credit is not given for both Industrial Engineering 382 and 282. Prerequisite: Computer Science 101; Mechanical Engineering 185 and 234. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Industrial Engineering Analysis.** Analysis and development of analytical techniques for the solution of problems in industrial engineering; application of statistical methods to uncertainty problems; analysis of linear programming techniques appropriate to the solution of allocation problems dealing with materials, money, men, and machines; and queuing theories applied to maintenance and inventories. Prerequisite: Industrial Engineering 286 and Mathematics 263, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
393. **Special Problems.** Study of advanced problems related to industrial engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or $\frac{1}{2}$ to 1 unit.
401. **Scientific Management, I.** Same as Business Administration 401. A study of modern management principles on the basis of quantitative methods, concentrating on such operation research techniques as nonlinear and dynamic programming and queueing theory. Prerequisite: Industrial Engineering 386 and Mathematics 361, or consent of instructor. 1 unit.
402. **Scientific Management, II.** Same as Business Administration 402. A systems approach to industrial problems involving inventory control, scheduling and line balancing, and maintenance and investment theory; application of formally accumulated knowledge of operation research techniques. Problems from industry are assigned to small teams of students. Prerequisite: Business Administration 401 or Industrial Engineering 401; background in computer technology or consent of instructor. 1 unit.
416. **Design of Construction and Industrial Operations, I.** Same as Civil Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues, and inventory models required for systems design; and design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering; credit or concurrent registration in Mathematics 363; or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Civil Engineering 417. Continuation of Industrial Engineering 416. Prerequisite: Industrial Engineering 416 or Civil Engineering 416; credit or concurrent registration in Mathematics 315; or consent of instructor. 1 unit.
453. **Work Measurement.** A study of special problems of line balance, interference, and automation work loads as required to establish work standards (or production standards). Prerequisite: Industrial Engineering 332. 1 unit.
454. **Production Engineering.** Advanced consideration of production engineering principles as related to cost analysis and reduction, control of flow of work in manufacture, evalu-

ation of performance against standard, and compensation; special investigations. Prerequisite: Industrial Engineering 453. 1 unit.

- 458. Laboratory Investigations in Industrial Engineering.** Special investigations of such problems as optimization of operations, programming systems, work standards, plant layout, and flow of materials. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
- 473. Ergonomics Seminar.** Same as Physiology 473 and Physical Education 473. In-depth exploration of topics in ergonomics such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Industrial Engineering 306 or consent of instructor. $\frac{1}{2}$ unit.

Mechanical Engineering

- 180. Engineering Materials and Processes.** Study of the materials, equipment, and processes used in the manufacture of goods; correlates materials and the methods used in their processing. Designed for students in nonengineering curricula. Prerequisite: Sophomore standing. 3 hours.
- 185. Materials Processing and Production Technology.** Technical aspects of manufacturing processes; principles of metal casting, welding, and other processes involving application of heat; mechanics of chip formation; cold forming processes; and conventional and nonconventional metal removal processes. Laboratory experiments and reports. Prerequisite: Chemistry 102; Physics 106; credit or concurrent registration in Mathematics 140, 141, or 145. 4 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 202. Thermodynamics and Heat Transfer.** Heat and work transfers and their effects on properties of simple working media undergoing nonflow and steady-flow processes; heat transfer by conduction, convection, and radiation. Prerequisite: Mathematics 345; Physics 107; Theoretical and Applied Mechanics 154 or 211. 3 hours.
- 205. Thermodynamics.** Introduction to classical thermodynamics through the second law; system and control volume analyses of thermodynamic processes; irreversibility and availability; relations among thermodynamics properties; and discussion of microscopic aspects. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
- 206. Thermodynamics.** Analysis of processes and systems for power generation and refrigeration; design cases including compressors, pumps, and turbines; mixing, combustion, and heat exchange; and modelling, power cycles, air conditioning, refrigeration, and cryogenics systems. Prerequisite: Mechanical Engineering 205 or 207. 3 hours.
- 207. Thermodynamics.** Energy and its transformations; properties of thermodynamic media, including kinetic theory analysis; thermodynamic processes of open and closed systems; reversibility and limitations; entropy and the second law; thermodynamics temperature scales; and second law analysis of chemically reactive systems. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
- 209. Thermodynamics and Heat Transfer.** Thermodynamic analysis of energy transfer and transformation; properties of simple working substances; analysis of open and closed systems, direct and reversed cycles, and processes involving transfers of mass and energy; and basic laws of heat transfer. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
- 210. Introduction to Engineering Experimentation.** Design and planning of engineering experiments on the basis of scientific analysis; execution of basic engineering experiments using fundamental measurement instruments and techniques; analysis, correlation, and evaluation of experimental data using mathematical and statistical concepts; and introduction and utilization of analog and digital computer methods. Prerequisite: Concurrent registration in Mathematics 345 and Mechanical Engineering 220. 3 hours.
- 211. Introductory Gas Dynamics.** Introduction to dynamics; special emphasis on the theory and engineering applications of compressible high velocity flows. Prerequisite: Mathe-

- atics 345; credit or concurrent registration in Mechanical Engineering 210; Physics 107. 3 hours.
213. **Heat Transfer.** Principles and application of heat transfer by conduction, convection, and thermal radiation. Students are not given credit for both Mechanical Engineering 213 and 254. Prerequisite: Mechanical Engineering 211. 3 hours.
220. **Mechanics of Machinery.** Linkages, cams and gears, velocities, accelerations, inertia forces, vibrations, critical speeds, balancing of engines, and gyroscopes. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or concurrent registration in Theoretical and Applied Mechanics 211; credit or concurrent registration in Computer Science 101. 4 hours.
224. **Design of Machine Elements.** Application of the principles of mechanics and physical properties of materials to the proportioning of machine elements; consideration of function, production, and economic factors. Prerequisite: Mechanical Engineering 220; Theoretical and Applied Mechanics 221. 3 hours.
234. **Heat Treatment of Metals.** Effects of heat treatment upon physical properties and structure of metals; heat treating operations; study of structures and physical properties; hardenability and grain size; special steels for extreme service requirements; and selection and heat treatment of steels based on performance requirements. Prerequisite: Theoretical and Applied Mechanics 221; credit or concurrent registration in Mechanical Engineering 224. 3 hours.
250. **Thermoscience Laboratory.** Basic experiments in thermodynamics, gas dynamics, and heat transfer and their applications; experiments selected to introduce pertinent instrumentation and experimental techniques, and to further the understanding of fundamentals via physical observations. Prerequisite: Mechanical Engineering 205 and 213. 3 hours.
254. **Heat Transfer and Gas Dynamics.** Principles and applications of heat transfer; basic concepts of compressible fluid flow. Students are not given credit for both Mechanical Engineering 213 and 254. Prerequisite: Mechanical Engineering 205; credit or concurrent registration in Theoretical and Applied Mechanics 235. 3 hours.
257. **Gas Turbines.** Theory, analysis, and performance of gas turbines; thermodynamic cycle analysis; performance parameters; structural components and gas dynamics of turbine blades; centrifugal and axial compressors; and basic laboratory work involving fundamental variables and their effects on performance. Prerequisite: Mechanical Engineering 206 and 212, or equivalent. 3 hours.
260. **Air Flow and Conditioning.** Synthesis of principles of fluid mechanics, heat transfer, and thermodynamics in the flow and conditioning of air; combined heat- and mass-transfer relations for the air-water vapor system; and applications to the engineering design of heating, ventilating, air conditioning, and other process-industry systems. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours.
265. **Principles of Control Systems.** Introduction to servomechanisms and control systems; modeling of dynamic elements, linearization, and block diagram algebra; steady state, transient response and frequency response of control systems; and stability criteria, design, compensation, and performance characteristics. Prerequisite: Mechanical Engineering 210 or senior standing, or consent of instructor. 3 hours.
271. **Design of Machine Elements.** Continuation of Mechanical Engineering 224. Prerequisite: Mechanical Engineering 224. 3 hours.
275. **Creativity in Engineering Design.** Study of engineering systems to show the creative use of scientific principles and design procedures; survey of natural laws and examples of their creative application; and introduction to methods for promoting creativity in engineering. Prerequisite: Mechanical Engineering 271. 3 hours.
284. **Welding Engineering.** Study of the fundamentals of welding processes and design of weldments; types, characteristics, and performance of various welding machines and processes; resistance welding and machine welding; inspection and testing of welds; design of weldments based upon suitable size, type, and location of welds; application to

the production of machines and structures; and supplementary laboratory experiments. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours.

290. **Senior Project Laboratory.** The planning, designing, execution, and evaluation of a technical project in order to provide the student with an opportunity to assume individual responsibility in this area. Responsibility for the selection, development, and completion of the project is placed on the student, subject to consent of the instructor. Prerequisite: Senior standing in mechanical engineering. 2 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of mechanical engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in mechanical engineering; must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in mechanical engineering research. Prerequisite: Senior standing in mechanical engineering; consent of head of department. 3 hours.
296. **Honors Project.** Same as Aeronautical and Astronautical Engineering, Electrical Engineering, and Industrial Engineering 296. Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Same as Aeronautical and Astronautical Engineering, Electrical Engineering, and Industrial Engineering 297. Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Mechanical Engineering 293 or 296. 3 hours.
301. **Thermodynamics.** Basic considerations of the three laws of thermodynamics; elementary statistical principles for the prediction of properties of pure substances and mixtures; transport properties; and electric and magnetic systems. Prerequisite: Mechanical Engineering 206 or equivalent; consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **Nuclear Power Engineering.** Same as Nuclear Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering; includes such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
303. **Dynamics of Aerosols and Hydrosols.** Same as Civil Engineering 359. Theory and application of the basic relations of fluid dynamics, thermodynamics, and heat transfer to the motion of aerosols and hydrosols, with application to problems in air and water pollution. Prerequisite: Senior or graduate standing. 3 hours or 1 unit.
304. **Direct Energy Conversion.** Direct conversion of chemical, nuclear, and solar energies into electricity by electrochemical, thermionic, thermoelectric, photoelectric, photochemical, ferroelectric, magnetohydrodynamic, and plasma systems. Prerequisite: Mechanical Engineering 301 or consent of instructor; Mathematics 345. 3 hours, or $\frac{3}{4}$ or 1 unit.
305. **Thermodynamics of High-Velocity Flow.** The thermodynamics of gases during high-velocity flow within enclosed channels using Mach number as the fundamental variable; analyses of the basic flow equations, effects of friction, and plane shock theory; and application to thermodynamic cycles involving nozzles, diffusers, compressors, combustion, and turbines. Prerequisite: Mechanical Engineering 205 and 211, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **Industrial Heat Transfer.** Theory and application of numerical, analogical, and experimental methods to selected heat transfer problems; application of principles of convection, condensation, and boiling heat transfer to design of heat exchange equipment.

Prerequisite: Undergraduate courses in fluid mechanics and heat transfer. 4 hours or 1 unit.

311. **Instrumentation and Measurements.** Same as Agricultural Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; and instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
312. **Modern Control Theory.** The concept of state; state-space representation of systems; transfer function decomposition and state-variable diagrams; state response of continuous and discrete-data systems; determination of the transition matrix; diagonalization; state response of time-varying systems; controllability and observability; stability and Lyapunov's method; and introduction to optimization and design. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.
314. **Lubrication.** The theoretical basis of lubrication, hydrodynamic bearing theory, and properties of lubricants; lubrication methods and appliances; and study of the lubrication requirements of machines of many kinds. Prerequisite: Undergraduate courses in machine design and fluid mechanics. 3 hours, or $\frac{3}{4}$ or 1 unit.
321. **Refrigeration and Cryogenics.** The theory of operation and the design of equipment for the production of low temperatures from below ambient down to near absolute zero; applications to industrial, consumer, aerospace, medical, and various research uses. Prerequisite: Mechanical Engineering 206, 211, and 213, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
323. **Design of Thermal Systems.** Selection of components in fluid- and energy-processing systems to meet system performance requirements; computer-aided design; system simulation; optimization techniques; and investment economics and statistical combinations of operating conditions. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Internal Combustion Engines.** Study of the fundamental principles underlying the theory and analysis of reciprocating internal combustion engines, fuels, carburetion, combustion, exhaust emissions, detonation, fuel injection, and factors affecting performance; basic laboratory work involving measurements of effects of variables on performance. Prerequisite: Mechanical Engineering 206 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Theory of Internal Combustion Engines.** Analysis of reciprocating engine cycle, including thermodynamics and combustion, taking into consideration effects of fuel-air mixture, variable specific heats, chemical equilibrium and dissociation, and heat losses; flow through manifolds and valves; factors affecting breathing and scavenging; supercharging; bearings, lubrication, and friction; and effects of variables on performance. Prerequisite: Undergraduate course in internal combustion engines or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Power Systems Engineering and Economy.** Application of thermodynamics principles and fluid flow and heat transfer processes to power systems; determination of system characteristics and methods to satisfy these requirements with awareness of economic factors and ecological considerations. Prerequisite: Mechanical Engineering 206, 211, and 213, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **Automotive Vehicle Dynamics.** Introduction to the dynamics and control of automotive multidegree of freedom systems; the development and solution of governing equations for both steady state and transient conditions by computer simulation techniques; investigation of the performance, handling, and safety aspects of vehicles and their interaction with external and internal interfaces; examination of the influence of tires, suspension, steering, and aerodynamic forces; and laboratory experiments and demonstrations. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.

341. **Engineering Analysis and Design.** Correlation of previously acquired design experience with the creative problem of synthesis and analysis that depend upon design judgment. Prerequisite: Mechanical Engineering 271 or senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
342. **Kinematic Analysis and Synthesis.** Geometry of constrained motion; application of mathematical and other techniques to the kinematic analysis and synthesis of mechanisms. Prerequisite: Undergraduate course in kinematics and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
343. **Dynamics of Machinery.** A course complementary to the undergraduate course; emphasis on the analytical approach to the study of dynamic forces in machines, balancing, critical speeds, shaft vibration, governors, and gyroscopes. Prerequisite: Mechanical Engineering 220 and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, General Engineering, Geography, Urban Planning, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as health effects and economic damage, and the political, legal, urban planning, and engineering implications of air pollution as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or $\frac{1}{2}$ unit.
388. **Industrial Control Systems.** The study of industrial control techniques by case studies of actual industrial systems; provides competence in the design, selection, and maintenance of industrial control systems; and introduces applications to electromechanical, pneumatic, thermal, and hydraulic systems. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
393. **Special Problems.** Study of advanced problems related to mechanical engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or $\frac{1}{2}$ to 1 unit.
401. **Thermodynamics and Transport Properties.** Thermodynamic and microscopic considerations for the prediction of properties; caratheodory principle; relations among properties; microscopic considerations and statistical methods; thermodynamic and transport properties; and fluctuation and nonequilibrium thermodynamics. Prerequisite: Mechanical Engineering 301 or consent of instructor. 1 unit.
402. **Nonequilibrium Processes.** Dynamics and thermodynamics of multiphase and multi-component systems with special relevance to air pollution control and energy conversion; relaxation phenomena; general motion of systems of disparate elemental masses; diffusion in gravitational and electric fields, and boundary layer motion with mass transport; dispersion and collection of particular matter; and transport with surface reactions. Prerequisite: Mechanical Engineering 301 and 303, or consent of instructor. 1 unit.
403. **Fundamentals of Combustion.** Same as Aeronautical and Astronautical Engineering 438. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames, their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; and supersonic burning. Prerequisite: Mechanical Engineering 305 or Aeronautical and Astronautical Engineering 213. 1 unit.
404. **Gas Dynamics, I.** Introduction to theoretical gas dynamics; fundamental laws and basic equations for subsonic, transonic, and supersonic steady and unsteady flow processes. Prerequisite: Mechanical Engineering 305 or equivalent, or consent of instructor. 1 unit.
405. **Convective Heat Transfer.** Fundamentals of convective heat transfer; calculation of heat transfer within conductor and over submerged objects for laminar and turbulent flow; natural convection; film condensation and boiling; and liquid metals. Prerequisite: Mechanical Engineering 306 or consent of instructor. 1 unit.
406. **Heat Conduction in Solids.** Fundamentals of heat conduction in isotropic and anisotropic solids; methods of solution to steady and transient heat conduction problems in

- one, two, and three dimensions; internal heat sources; periodic flow of heat; problems involving phase change; and approximate analytical techniques. Prerequisite: Mechanical Engineering 306 or Mathematics 346, or consent of instructor. 1 unit.
408. **Laboratory Investigation in Thermodynamics.** Special investigations involving thermodynamic analysis, thermodynamic properties, and performance of physical and chemical systems. Prerequisite: One-year course in thermodynamics; one half-year course in power laboratory. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
409. **Laboratory Investigations in Fluid Flow, Heat Transfer, and Combustion.** Special investigation in flow, metering, heat transfer, and heat exchanger performance and design. Prerequisite: Courses in thermodynamics and fluid mechanics. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
410. **Thermal Radiation.** Fundamentals of radiant energy transport in absorbing and non-absorbing media; pyrometry; and applications to selected problems involving combined energy transport mechanisms. Prerequisite: Mechanical Engineering 306 or consent of instructor. 1 unit.
411. **Control of Air Pollution from Stationary Sources.** Same as Civil Engineering 448. The study of the basic theory of pollution control devices and their application to air pollution control problems. Prerequisite: Credit or concurrent registration in Civil Engineering 340 and 343, or consent of instructor. 1 unit.
412. **Analysis of Air Pollutants.** Same as Civil Engineering 449. Laboratory analysis of common air pollutants; theory of operation of laboratory and automatic field instrumentation. Prerequisite: Civil Engineering 343 or consent of instructor. $\frac{3}{4}$ unit.
421. **Environmental Control.** Same as Architecture 421. Design of environmental systems for buildings; integration of mechanical, structural, and architectural demands, in lectures and through a semester design project. Prerequisite: Undergraduate courses in heat transfer and fluid mechanics. 1 unit.
423. **Thermal Systems.** Steady-state simulation and optimization of thermal systems, dynamic performance, and probabilities in system design. Prerequisite: Mechanical Engineering 323. 1 unit.
428. **Investigations in Thermal Systems.** Investigations in the modeling, simulation, and optimization of thermal systems such as power generating, heating and cooling, and thermal processing systems. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
429. **Investigations in Environmental Control.** Investigations in heating, ventilating, air conditioning, and human comfort. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
432. **Theory of Rotary Compressors.** Thermodynamical and mechanical fundamentals; compression with and without cooling; classification of compressors; similarity considerations and characteristics; principles of and computations for radial compressors; improvement in performance of integrating parts; axial flow compressors; lattice and air-foil theory; change in operating conditions of turbo-compressors; regulation; and rotary positive blowers. Prerequisite: Mechanical Engineering 205, 206, and 211; or Aeronautical and Astronautical Engineering 211. 1 unit.
438. **Laboratory Investigations in Power Machinery.** Special investigations in power machinery, such as turbines, engines, fans, and compressors. Prerequisite: One-year course in power laboratory. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
441. **Machine Design.** A technical application course that focuses the previously acquired design experience on the creative problem of developing machines to perform specified functions; proper considerations of manufacturing processes involved; and checking of all parts for stress, wear, vibration, fatigue, etc. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.
442. **Linkage Synthesis.** Geometry of constrained motion in two and three dimensions; application of mathematical and other techniques to the synthesis of mechanisms. Prerequisite: Mechanical Engineering 342 or consent of instructor. 1 unit.
443. **Dynamics of Machinery.** Complementary to the undergraduate course and devoted to a more detailed study of velocities, accelerations, and forces in machine parts having reciprocating, rotating, and combined motions; balancing; flywheels; and special top-

ics. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.

- 445. Design of Internal Combustion Engines.** Detailed study of the design of the internal combustion engine; gas-pressure and inertia-force diagrams; determination of bearing loads; torsional vibration analysis; and stress determinations and design of important parts, including piston, connecting rod, crankshaft, flywheel, valve mechanism, and cam layout. Prerequisite: Undergraduate courses in dynamics of machines and in internal combustion engines; one year of machine design. 1 unit.
- 448. Laboratory Investigations in Machine Design.** Special investigations in machine design. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
- 451. Theory of Metal Cutting.** Study of the theoretical factors involved in metal cutting and forming; basic mechanics of chip formation, friction, surface damage and finish; temperatures and temperature distribution during cutting; wear and tool-work compatibility; analysis of experimental data; critical review of pertinent literature; and special topic assignments. Prerequisite: Undergraduate course in principles of metal cutting and heat treatment of metals or physical metallurgy. 1 unit.
- 458. Laboratory Investigations in Production.** Special investigations in field of production, particularly in materials processing, metal cutting, and production engineering. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
- 493. Seminar.** Required of all graduate students each semester with the exception of doctoral candidates who have passed their preliminary examination. Presentation and discussion of significant developments in mechanical engineering. 0 credit.
- 497. Special Problems in Mechanical Engineering.** Lectures, seminars, and individual investigations or studies in selected areas of mechanical engineering. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated.
- 499. Thesis Research.** 0 to 4 units.

MEDICAL SCIENCES

Dean of School: Dean D. K. Bloomfield

School Office: 1205 West California Avenue, Urbana

- 300. Medical Sciences.** First-year program in preparation for the M.D. degree involving independent study of anatomy, behavioral science, biochemistry, genetics, immunology, microbiology, neural science, pathology, pharmacology, physiology, and reproductive biology. Elements of clinical experience are included. Learning experiences are monitored and presented by faculty in the clinical and basic medical sciences. Prerequisite: Enrollment is limited to students accepted by the College of Medicine. 19 hours (summer session, 9 hours).

METALLURGY AND MINING ENGINEERING

(Including Petroleum Engineering)

Head of Department: Professor C. A. Wert

Department Office: 201 Metallurgy and Mining Building, Urbana

Metallurgical Engineering

199. **Undergraduate Open Seminar.** 0 to 9 hours.
207. **Extractive Metallurgy.** Basic processes for the recovery of metals from their ores; mineral beneficiation; smelting, refining, and related processes; and hydrometallurgical methods. Prerequisite: Junior standing in metallurgical engineering or equivalent. 3 hours.
296. **Metallurgical Seminar.** Review of current metallurgical literature; classroom reports and discussions; and preparation of technical abstracts and reports. Prerequisite: Senior standing in metallurgical engineering. 2 hours.
299. **Thesis.** Investigation of special problems and preparation of a thesis. May be substituted for certain technical subjects in the senior year. Prerequisite: Senior standing; approval of head of department. 1 to 3 hours.
301. **Welding and Joining Processes.** Same as Civil Engineering 375. The physical principles of fusion welding; heat flow; thermal cycles; physical metallurgy and mechanical properties of welded joints; applications of welding to large structures; testing of welds; nondestructive testing; design, economics, and weld specifications; and laboratory experiments in welding. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **Powder Metallurgy.** Production and testing of powdered metals; fabrication and application of metal shapes produced from powdered metals. Prerequisite: Approval of department; concurrent registration in Metallurgical Engineering 304; senior standing. 2 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit.
304. **Powder Metallurgy Laboratory.** Experiments involving the testing, briquetting, sintering, and repressing of metal powders, and the testing of sintered compacts. Prerequisite: Approval of department; concurrent registration in Metallurgical Engineering 302; senior standing. 1 hour or $\frac{1}{4}$ unit.
306. **Design of Engineering Alloys.** A study of the fundamental principles which determine the constitution, structure, treatment, and application of alloy steels and other special-purpose high-performance alloys. Prerequisite: Metallurgical Engineering 372. 3 hours, or $\frac{3}{4}$ or 1 unit.
307. **Corrosion of Metals.** Electrochemistry, thermodynamics, and kinetics of corrosion; behavior of ferrous and nonferrous metals; corrosion rates; corrosion control; cathodic and anodic protection; high-temperature corrosion; corrosion testing; and electrolytic machining methods. Prerequisite: Mechanical Engineering 234 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
310. **Crystallography and Diffraction.** Study of structure and composition of solids using X-rays and electron beams; radiography, spectroscopy, and X-ray and electron metallography. Prerequisite: Physics 108. 4 hours or 1 unit.
311. **Advanced Phase Diagrams.** The determination and interpretation of multicomponent phase diagrams. Prerequisite: Metallurgical Engineering 370 or equivalent. 3 hours or $\frac{3}{4}$ unit.
314. **Metallurgical Thermodynamics.** Thermodynamic principles applied to the study of phase and chemical equilibrium and to the calculation of free energy of phases. 3 hours or $\frac{3}{4}$ unit.
315. **Metallurgical Kinetics.** Diffusion and heat flow calculations and their applications to

kinetics of metallurgical processes. Prerequisite: Metallurgical Engineering 314 and 372. 3 hours or $\frac{3}{4}$ unit.

316. **Mechanical Metallurgy.** Fundamentals of plastic deformation of crystalline solids; elementary theory of statics and dynamics of dislocations; applications to deformation of single crystals and polycrystals; fracture; and effect of metallurgical variables on mechanical properties. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
318. **Physics of Metals.** The nature of the perfect and imperfect crystal, the electronic structure of solids, electrical conduction in metals and semiconductors, and dielectric and magnetic properties of solids. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
334. **Physical Metallurgy for Engineers.** Fundamentals of crystallography, imperfections, alloying, and deformation; consideration of composition, temperature, and prior thermal and mechanical treatment in the use of metals, with emphasis on their mechanical properties. Prerequisite: Credit or concurrent registration in Theoretical and Applied Mechanics 221 or Aeronautical and Astronautical Engineering 224, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
370. **Physical Metallurgy, I.** First of a two-semester sequence treating metallurgical phenomena and their utilization in engineering materials and processes; defects, diffusion, phase diagrams, solidification and casting, and plastic deformation and annealing. Prerequisite: Junior standing in engineering; Mathematics 345; Theoretical and Applied Mechanics 221. 3 hours or $\frac{3}{4}$ unit.
371. **Physical Metallurgy Laboratory, I.** Laboratory course to be taken simultaneously with Metallurgical Engineering 370. Experiments using various metallographic, physical, and mechanical property observations to relate structure to properties and illustrate behavior of materials. Prerequisite: Concurrent registration in Metallurgical Engineering 370. 3 hours or 1 unit.
372. **Physical Metallurgy, II.** Continuation of Metallurgical Engineering 370. Precipitation; eutectoid reactions; martensite; ordering; surface reactions; cast iron; and joining. Prerequisite: Metallurgical Engineering 370 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
373. **Physical Metallurgy Laboratory, II.** Laboratory course to be taken simultaneously with Metallurgical Engineering 372. Experiments using various metallographic, physical, and mechanical property observations to relate structure to properties and illustrate behavior of materials. Prerequisite: Concurrent registration in Metallurgical Engineering 372. 3 hours or 1 unit.
384. **Properties of Solids.** Perfect and imperfect crystal lattices; electronic structure of solids including basic theory and applications to transport properties of metals and semiconductors; semiconductor diodes; and dielectric and magnetic properties of solids. Prerequisite: Physics 383. 3 hours or $\frac{3}{4}$ unit.
386. **Electron Microscopy and Diffraction Theory.** Theory and application of transmission electron microscopy and diffraction with emphasis on thin crystals; electron optics, interference phenomena, interpretation of images and diffraction patterns, specimen preparation, etc. Students interested in laboratory experience may enroll in Chemistry 429. Prerequisite: Metallurgical Engineering 310 or equivalent. 3 hours or 1 unit.
407. **Plastic Deformation and Annealing of Metals.** The mechanism and crystallography of plastic deformation of single crystals and of polycrystalline metals; annealing effects; recovery, subgrain growth, and recrystallization; and deformation textures and annealing textures. Prerequisite: Consent of instructor. 1 unit.
408. **Dislocations and Mechanical Properties of Metals.** General static and dynamic properties of single dislocations in crystals; dislocation interactions; properties of dislocation arrays; and role of dislocations in metallurgical phenomena with particular emphasis on mechanical properties. Prerequisite: Consent of instructor. 1 unit.
409. **Crystal Physics.** The anisotropic properties of crystals treated by tensor and matrix methods with application to paramagnetism, conduction and diffusion, thermoelectricity, deformation, elasticity, and martensitic transformations; discussion of the effects of

crystal symmetry and the properties of aggregates. Prerequisite: Vector algebra, determinants, and thermodynamics; consent of instructor. 1 unit.

410. **Advanced X-Ray Metallography.** X-ray diffraction as applied to the study of metals and alloys; effects of cold work, annealing, substructures, preferred orientation, and ordering; and principles of electron and neutron diffraction. Prerequisite: Chemistry 427 or consent of instructor. 1 unit.
420. **Metallurgical Thermodynamics.** Fundamental thermodynamic considerations and applications of thermodynamics to metallurgical problems; particular emphasis on heterogeneous equilibrium and thermodynamic properties of solutions. Topics approached from the viewpoints of both macroscopic thermodynamics and statistical mechanics. Prerequisite: Metallurgical Engineering 314 or equivalent. 1 unit.
421. **Kinetics of Phase Changes in Metals.** The viewpoint of statistical thermodynamics, rate theory, diffusion in solids, interface energy, nucleation theories, and phenomenological analysis of nucleation and growth; application to crystal growth, diffusionless phase changes, oxidation, pearlite reaction, precipitation, and sintering. Prerequisite: Metallurgical Engineering 420 or consent of instructor. 1 unit.
430. **Surface Physics.** Same as Physics 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction and structure; gas-solid collisions; Brownian motion, diffusion, and evaporation; electron and ion emission, tunnelling; Van der Waals forces; theory of chemical interactions; and kinetics and statistics of adsorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
485. **Metallurgical Engineering Problems.** Individual study in areas of metallurgical engineering not covered by regular course offerings; carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
486. **Laboratory Investigations in Metallurgy.** Special investigations in metallurgy to provide an opportunity to employ some advanced experimental methods of research. Available only to nonthesis students enrolled in a Master of Science program. Prerequisite: Consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.
492. **Seminar on Surfaces.** Discussions and lectures on current research on surfaces and related areas. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
493. **Seminar on Anelasticity.** Lectures and discussions of the nature of anelasticity and its application to metallurgy. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
494. **Seminar on Phase Transformations in Metals.** Discussion of current research in this field including presentation by graduate students of their own work. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
495. **Seminar on Diffusion and Imperfections.** Lectures and discussions on diffusion and imperfections in crystalline solids. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
497. **Seminar on Alloy Phases.** Discussion and lectures on current research, including work by the graduate students, relating to the electronic structure and crystal structure of alloy phases. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
498. **Colloquium in Physical Metallurgy.** Review of current metallurgical research in other laboratories by visiting lecturers. Some of the research currently done in the department is also reviewed. Required of all graduate students in metallurgical engineering. No credit.
499. **Thesis Research.** Individual research in specialized problems under the supervision of members of the staff. Results of research may be used for graduate thesis. 0 to 4 units.

Mining Engineering

302. **Political, Economic, and Environmental Aspects of Minerals and Their Utilization.** The availability and utilization of national and world mineral resources and the related environmental, economic, and political implications are examined through lectures,

readings, student reports, panel discussions, guest speakers, field trips, and films. Prerequisite: Economics 108 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

351. **Geophysical Prospecting.** Same as Geology 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
356. **Rock Mechanics.** Mechanical properties of rocks; design of mine openings in bedded, massive, and fractured rock; methods of support; drilling; and blasting. Prerequisite: Mining Engineering 351. 3 hours, or $\frac{3}{4}$ or 1 unit.
393. **Special Problems.** Individual studies of any phase of mining or petroleum engineering selected by the student and approved by his adviser and the staff member who supervises the study. Prerequisite: Consent of instructor. 0 to 4 hours, or 0 to 1 unit.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy 414 and Ceramic Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 and 341, or equivalent, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
497. **Special Problems.** Individual studies in areas of mining or petroleum engineering not covered by regular course offerings; carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. 0 to 2 units.
499. **Thesis Research.** Individual research in some phase of the general field of mining or petroleum engineering under the supervision of a member of the staff. 0 to 4 units.

Petroleum Engineering

371. **Reservoir Mechanics, I.** The mechanics of the movement of fluids in the porous rock reservoirs of the subsurface, especially as related to questions dealing with the production and storage of petroleum fluids, ground water, and natural gases. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 235. 3 hours or 1 unit.
373. **Advanced Reservoir Engineering.** Physical principles of oil production including the hydrodynamics of the recovery process; attention to the valuation and practical economic aspects. Prerequisite: Petroleum Engineering 372 or consent of instructor; Mathematics 345. 3 hours, or $\frac{3}{4}$ or 1 unit.

MICROBIOLOGY

(See Life Sciences)

MILITARY SCIENCE

Head of Department: Colonel T. R. Woodley

Department Office: Room 110w Armory, Champaign

100. **Leadership Laboratory.** For first semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
101. **Introduction to Military Science (United States Defense Establishment, I).** An introduction to military life, customs, and organization; achievement of a practical working knowledge of individual weapons and their utilization. 1 hour.

102. **Military Map and Aerial Photograph Analysis.** Fundamentals of military map and aerial photograph reading; includes the application of basic principles emphasizing terrain appreciation and evaluation; marginal information; military and topographic map symbols; methods of orientation and resection; military grid reference systems; and classes of aerial photography and methods of obtaining the same. 1 hour.
103. **Introduction to Tactics.** Introduction to the basic principles and fundamentals of tactics and their application to the employment of squad- and platoon-sized units in offensive and defensive military operations. Prerequisite: Credit or concurrent registration in Military Science 101; concurrent registration in Military Science 125. 1 hour.
111. **United States Army and National Security (United States Defense Establishment, II).** A survey course in the problems of the United States national defense policy, and the role of the United States Army in implementation of that policy. 1 hour.
112. **American Military History.** Develops certain basic concepts useful for the study of military history and for the study of current problems of national defense; gives the student a sense of perspective and continuity of the main developments in the history of warfare, and the relation of war to society; discussions of land, sea, and air war through an examination of the relation of strategy and tactics to geography, economics, sociology, and technology through the ages; analyzes the relationship between civilians and soldiers in various forms of government; surveys main developments in the history of warfare as they have affected American military history; and examines the effects of nuclear weapons on traditional concepts. 2 hours.
125. **Leadership Laboratory.** For second semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
150. **Leadership Laboratory.** For first semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
175. **Leadership Laboratory.** For second semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
200. **Leadership Laboratory.** For first semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
201. **Principles of Military Instruction.** An introduction to the principles, methods, and techniques fundamental to military instruction to include lesson planning and presentation, use of training aids, and methods of evaluation. 1 hour.
202. **Introductory Military Operations (Fundamentals and Dynamics of the Military Team, I).** The application of the principles of offensive and defensive combat as applied to small tactical units; an analysis of the problem of insurgency and the methods used in its containment; and the means and methods of military communications and their use. Prerequisite: Approval of Professor of Military Science; concurrent registration in Military Science 200 or 225. 3 hours.
203. **Principles of Military Leadership.** Introduces the student to the principles of leadership, the responsibilities and techniques of military leaders, and the problems of leadership in the military environment. 1 hour.
210. **Military Law and Administrative Management.** An introduction to the fundamental concepts of military justice; the basic principles and methods of courts-martial procedure; and principles of nonjudicial punishment. 1 hour.
211. **Proseminar.** A lecture-discussion course utilizing guest lectures in politico-military and military affairs. Individual research projects and readings are required, and a general review of Military Science 102 is included. 2 hours.

- 212. Advanced Military Operations (Fundamentals and Dynamics of the Military Team, II).** An advanced study of military operations, logistics, and administration to include the study of the techniques and functions of commanders and staffs, and the fundamentals of supply and administration of platoons and companies. Prerequisite: Approval of Professor of Military Science; concurrent registration in Military Science 250 or 275. 3 hours.
- 225. Leadership Laboratory.** For second semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
- 250. Leadership Laboratory.** For first semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
- 275. Leadership Laboratory.** For second semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.

MINING ENGINEERING

(See Metallurgy and Mining Engineering)

MODERN GREEK

(See Linguistics)

MUSIC

Director of School: Professor L. T. Fredrickson

School Office: 3050 Music Building, Urbana

- 100. Rudiments of Theory.** Notation, scales, intervals, chords, and terminology. Open to students from other colleges of the University. 2 hours.
- 101. Fundamentals of Musical Analysis, I.** A basic course in the aural analysis of musical forms and procedures, and the development of melodic, harmonic, and rhythmic vocabularies. Prerequisite: Music 100 or equivalent; majors: concurrent registration in Music 108. 2 hours.
- 102. Fundamentals of Musical Analysis, II.** A continuation of 101 with gradually increased emphasis on visual elements (score reading and analysis). Prerequisite: Music 101 or 108, or equivalent; concurrent registration in Music 109. 3 hours.
- 103. Selected Studies in Style Analysis, I.** Practical use of the material presented in Music 102. The student may select from a variety of areas of particular emphasis suited to his own interests and curriculum. See Timetable for specific offerings. Prerequisite: Music 102. 4 hours. May be repeated for additional credit.
- 104. Selected Studies in Style Analysis, II.** Practical use of the material presented in Music 102. The student may select from a variety of areas of particular emphasis suited to his

- own interests and curriculum. See Timetable for specific offerings. Prerequisite: Music 102. 4 hours.
106. **Composition.** Music composition in its beginning and secondary stages; practice in phrase, sentence and period, analysis, and writing; writing of the shorter forms of music; and instruction in range, characteristic, and idiom of instruments. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 hours (summer session, 2 to 4 hours).
 108. **Rudiments of Musical Vocabulary and Notation.** Notation, scales, modes, intervals, chords, and terminology; lab-discussion with an individual approach. 1 hour.
 109. **Ear Training and Sight Singing.** An individual course that develops and improves the students' ability to sight sing and to coordinate aural and visual musical disciplines. Prerequisite: Music 108. 0 or 1 hour.
 110. **Basic Music Literature.** An introduction to the standard concert repertoire through intensive guided listening. Representative works by major composers are chosen to illustrate the principal forms, styles, and techniques of vocal and instrumental music from the time of Bach to the present. Two lectures and two listening hours per week; students register for the lecture and one quiz section. Required of freshmen in music. 2 hours.
 113. **Appreciation of Music.** Symphonic poems and symphonies. For nonmusic students. Students register for the lecture and one quiz section. Prerequisite: Sophomore standing. 2 hours.
 115. **Introduction to Opera.** Introduction to the art form, opera; a survey of its musical, dramatic, and stylistic development from 1600 to the present. Prerequisite: Sophomore standing. 2 hours.
 130. **Introduction to the Art of Music, I.** Designed for the layman to train students in intelligent listening and to acquaint them with many great works of the literature of music. For nonmusic students only. Students register for the lecture and one quiz section. 4 hours.
 131. **Introduction to the Art of Music, II.** Continuation of Music 130. For nonmusic students only. Prerequisite: Music 130. 4 hours.
 134. **Afro-American Music.** An introduction to Afro-American music in the United States, past and present, including its African and European origins, its relationship to European music, its social and historical context, and its relationship to Afro-American music elsewhere in the New World. Prerequisite: Music 130 or consent of instructor. 3 hours.
 142. **Elements of Conducting.** The development of basic techniques for conducting instrumental and vocal ensembles. Prerequisite: Sophomore standing in music or consent of instructor. 2 hours.
 150. **Jazz Piano Improvisation, I.** The study of jazz theory, harmony, and improvisational techniques at the piano; includes experience in solo and ensemble situations, and an historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109, or equivalent; consent of instructor. 2 hours.
 151. **Jazz Piano Improvisation, II.** Continuation of Music 150. The study of jazz theory, harmony, and improvisational techniques at the piano; includes experience in solo and ensemble situations, and an historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109, or equivalent; consent of instructor. 2 hours.
 160. **Group Instruction in Piano, I.** Beginning group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument; studies simple piano literature and the development of skills in technique, sight reading, harmonization, transposition, improvisation, and analysis. 2 hours.
 161. **Group Instruction in Piano, II.** Elementary group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument; easy solos from the main periods with appropriate technical development; continuation

of skills introduced in Music 160; and introduction of piano ensemble literature. Prerequisite: Music 160 or equivalent; consent of instructor. 2 hours.

162. **Group Instruction in Piano, III.** Intermediate group instruction in piano for music majors whose main performing medium is voice or an orchestral or band instrument; study of intermediate level solos and ensemble compositions; harmonization with chromatic chords, sight reading, transposition of four-voice works, improvisation, and learning of patriotic songs. Prerequisite: Music 161 or equivalent; consent of instructor. 2 hours.
163. **Group Instruction in Piano, IV.** Moderately advanced group instruction in piano for music majors whose performing medium is voice or an orchestral or band instrument; continuation of Music 162 with emphasis on solos, ensemble works, technical development, and more advanced work in sight reading, harmonization, improvisation, transposition, and aural skills. 2 hours.
165. **Class Instruction in Voice.** Group instruction in the fundamentals of singing. For School of Music students who do not major in voice; required of such students in music education. 2 hours.
166. **English Diction.** Phonetics applied to English song literature; individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
167. **Italian Diction.** Phonetics applied to Italian song literature; individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
168. **German Diction.** German pronunciation as applied to German vocal literature; class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.
169. **French Diction.** Principles of French pronunciation applied to French vocal literature; class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.
170. **String Instruments.** Class instruction in the fundamentals of playing violin, viola, cello, and string bass. Prerequisite: Junior standing in music or consent of instructor. 2 hours.
171. **Woodwind Instruments.** Class instruction in the fundamentals of playing and teaching clarinet, flute, saxophone, oboe, and bassoon. Prerequisite: Enrollment in the School of Music; for nonmusic majors, consent of instructor. $\frac{1}{2}$ or 2 hours.
172. **Brass Instruments.** Class instruction in the fundamentals of playing and teaching trumpet, French horn, trombone, baritone, and tuba. Prerequisite: Enrollment in the School of Music; for nonmusic majors, consent of instructor. $\frac{1}{2}$ or 2 hours.
173. **Percussion Instruments.** Class instruction in the fundamentals of playing and teaching percussion instruments. Prerequisite: Enrollment in the School of Music; for non majors, consent of instructor. 2 hours.
178. **Guitar.** Private instruction in guitar at the undergraduate level, predominantly classical. 2 or 4 hours (summer session, 1 or 2 hours).
179. **Harpischord.** Private instruction in harpischord at the undergraduate level. 2 or 4 hours.
180. **Piano.** Private instruction in piano at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
181. **Voice.** Private instruction in singing at the undergraduate level. 2 or 3 hours (summer session, 1 or 2 hours).
182. **Organ.** Private instruction in organ at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
183. **Violin.** Private instruction in violin at the undergraduate level. 2 or 4 hours (summer session 1 or 2 hours).
184. **Viola.** Private instruction in viola at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
185. **Cello.** Private instruction in violoncello at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).

186. **String Bass.** Private instruction in string bass at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
187. **Flute.** Private instruction in flute at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
188. **Clarinet.** Private instruction in clarinet at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
189. **Oboe.** Private instruction in oboe at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
190. **Bassoon.** Private instruction in bassoon at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
191. **Cornet and Trumpet.** Private instruction in cornet and trumpet at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
192. **French Horn.** Private instruction in French horn at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
193. **Trombone.** Private instruction in trombone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
194. **Baritone.** Private instruction in baritone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
195. **Tuba.** Private instruction in tuba at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
196. **Percussion.** Private instruction in percussion at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
197. **Harp.** Private instruction in harp at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
198. **Saxophone.** Private instruction in saxophone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Instrumentation, I.** Orchestration and arranging for orchestral groups. Prerequisite: Senior standing in music. 2 hours.
201. **Instrumentation, II.** Problems in arranging for all wind instruments. Required of composition majors. Prerequisite: Music 200 or consent of instructor. 2 hours.
213. **The History of Music, I.** Survey of music and its development in Western civilization to 1750; emphasis on an acquaintance with representative musical works and style, and on understanding musical concepts in the light of their historical background. Required of all music students. Prerequisite: Music 110 or consent of instructor. 3 hours.
214. **The History of Music, II.** Survey of the development of music as an art in Western civilization from 1750 to the present; emphasis on an acquaintance with formal and stylistic problems through the study of representative works, and on understanding specific musical concepts in the light of their historical and general cultural context. Required of sophomores in music. Prerequisite: Music 213. 3 hours.
229. **Thesis and Advanced Undergraduate Honors in Music.** Special individual research projects. Required of seniors in the history of music and composition-theory curricula; open also to advanced undergraduates, including James Scholars, who have achieved University or college honors and who desire to do research in specialized areas of music, including performance. Prerequisite: Senior standing in the history of music and composition-theory, or consent of instructor. 2 hours.
230. **Choral Literature and Conducting, I.** This course is organized on a laboratory basis with a twofold purpose: to survey and study different types of choral literature, and to afford students an opportunity to conduct the group in the singing of choral music suitable for high school groups. Prerequisite: Music 142. 2 hours.
231. **Choral Literature and Conducting, II.** Continuation of Music 230. Prerequisite: Music 230. 2 hours.
232. **Instrumental Literature and Conducting, I.** Survey of music literature for wind ensemble and band; principles of interpretation and techniques of conducting emphasized

through detailed study and performance of selected compositions. Prerequisite: Music 142. 2 hours.

233. **Instrumental Literature and Conducting, II.** Principles of interpretation and techniques of orchestral conducting emphasized through detailed study and performance of selected orchestral compositions appropriate for public school groups. Prerequisite: Music 232. 2 hours.
234. **Workshop in Elementary Music Education.** Detailed consideration of music objectives, principles of learning, and their implications for teaching methods; major emphasis on techniques and materials suitable for teaching music in the elementary school by the classroom teacher. Specifically designed for the experienced classroom teacher. Prerequisite: Consent of instructor; public school teaching experience. 2 hours. Offered in the summer session only.
235. **Elementary and Junior High School Instrumental Music.** Principles, materials, and pedagogical and organizational techniques for teaching instrumental music in the elementary and junior high school. 2 hours.
240. **Music for Elementary Teachers, I.** A presentation of music for students preparing to teach in the elementary schools; required for state elementary school certification, but not acceptable for credit in the School of Music. Prerequisite: Junior standing in elementary education or consent of instructor. 3 hours.
241. **Music for Elementary Teachers, II.** Continuation of Music 240. A presentation of music for students preparing to teach in the elementary schools; required for state elementary school certification, but not acceptable for credit in the School of Music. Prerequisite: Music 240. 3 hours.
242. **Teaching Music in the Elementary School.** Techniques of and material suitable for teaching music in the elementary school. Prerequisite: Junior standing in music education or consent of instructor. 3 hours.
243. **Teaching Music in the Junior High School.** Detailed consideration of the music program in the junior high school special emphasis on instructional material and methods of instruction. Prerequisite: Junior standing in music education or consent of instructor. 3 hours.
244. **Teaching of Instrumental Music.** Principles, techniques, organization, and materials for teaching instrumental music in the public school. Prerequisite: Consent of instructor. 2 hours.
245. **Choral Arranging.** Arrangement of suitable materials for choral organizations on the high school level. Prerequisite: Junior standing in music. 2 hours.
246. **Teaching of Choral Music.** Techniques of and materials suitable for organizing and teaching choral music in the public schools. Prerequisite: Junior standing in music education or consent of instructor. 2 hours.
248. **Music for Early Childhood Teachers, I.** Development of musical competencies essential for teachers in nursery schools and kindergartens; singing, rhythmic keyboard improvisation, and creative and music reading skills and extensive study of music materials suitable for use in early childhood music. Prerequisite: Junior standing; child development major. 3 hours.
249. **Music for Early Childhood Teachers, II.** Further development of the objectives stated in the description for Music 248; increasing emphasis on individual performance skill and further survey of materials appropriate for use in early childhood music. Prerequisite: Music 248. 3 hours.
250. **University Orchestra.** Prerequisite: Consent of instructor. 1 hour.
251. **Chamber Orchestra.** A chamber orchestra for the purpose of performing literature of all periods written specifically for a chamber-sized orchestra. Prerequisite: Consent of instructor. 1 hour.
252. **Wind Ensemble.** Mixed woodwind-brass-percussion ensembles for the study and performance of wind chamber compositions. Prerequisite: Junior standing or consent of instructor. 1 hour.

253. **Collegium Musicum.** Ensemble work in the performance of medieval, Renaissance, and baroque music; various small groups formed for the performance of sonatas and canatas of Bach and Handel, wind serenades of Mozart, etc. Interested students may play on viola, lute, harpsicord, and other instruments from the University's collection. Prerequisite: Consent of instructor. 1 hour.
254. **String Ensemble.** The student participates in various ensemble groups, such as trios, quartets, quintets, etc., for the study of chamber music literature. The course may be repeated or taken during the freshman and sophomore year without credit. Prerequisite: Consent of instructor. 1 hour.
255. **Woodwind Ensemble.** Prerequisite: Consent of instructor. 1 hour.
256. **Brass Ensemble.** Ensembles of mixed brasses in both small and large forms. Prerequisite: Consent of instructor. 1 hour.
257. **Percussion Ensemble.** Prerequisite: Consent of instructor. 1 hour.
258. **Piano Ensemble.** Prerequisite: Consent of instructor. 1 hour.
259. **Organ Keyboard Techniques.** Development of practical keyboard skills related to the work of the church organist; transposition, score-reading, harmonization, modulation, hymn-playing, and solo and anthem accompaniment. Prerequisite: Consent of instructor. 1 hour.
260. **Oratorio Society.** Performance of oratorios and other major choral works in cooperation with the University Symphony Orchestra; an advanced mixed-voice chorus open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
261. **University Chorus.** Performance of cantatas and other choral works; a mixed-voice chorus for average and beginning singers. Open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
262. **Women's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all women students. Prerequisite: Consent of instructor. 1 hour.
263. **Men's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all men students. Prerequisite: Consent of instructor. 1 hour.
264. **University Choir.** Practical experience in mixed-voice singing of accompanied and unaccompanied music of various periods and styles; a highly advanced group of competent student singers. Prerequisite: Consent of instructor. 1 hour.
265. **Opera Workshop and Ensemble.** Preparation and public performance of grand or light opera; covers the music and acting only. Students desiring experience in costuming, stage management, scenery, publicity, etc., should apply to the University Theatre which cooperates in the opera productions. Admission is by audition. Prerequisite: Consent of instructor. 1 hour.
266. **Jazz Band.** Designed to acquaint proficient instrumentalists with jazz compositions, arrangements, and improvisational procedures, and to promote a high degree of stylistic and technical competence in performance. Prerequisite: Consent of instructor, determined by auditions. 1 hour.
267. **Harp Ensemble.** Ensembles of multiple harps and harp in combination with other instruments. Prerequisite: Consent of instructor, or Music 197 and/or 397. 1 hour.
268. **Small Choral Ensembles.** Open to a limited number of undergraduate students who desire experience in performance of music specifically written for smaller choral groups. Membership through audition only. Prerequisite: Consent of instructor. 1 hour.
300. **Eighteenth-Century Counterpoint.** Study of the technique of contrapuntal writing as found in the works of J. S. Bach and other eighteenth-century composers; imitation, canon, invertible counterpoint, two- and three-part inventions, etc., studied through writing and analysis of compositions by eighteenth-century composers. Prerequisite: Music 104 and/or consent of instructor. 3 hours or ½ unit.
301. **Fugue.** Study of fugal writing during the eighteenth and early nineteenth centuries; a continuation of the study of tonal counterpoint begun in Music 300, with special emphasis on the study and analysis of the fugal works of J. S. Bach, Handel, and Beetho-

ven, and on the writing of fugues and parts fugues. Prerequisite: Music 300 and/or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

302. **Musical Acoustics, I.** History of music, science, and technology; introduction to sets and functions; definition of acoustical parameters: frequency (pitch), amplitude (loudness), and spectrum (sound quality); measurement of decibel level and frequency response; harmonic spectrum analysis; sound perception; acoustic waves; and acoustics of string, wind, and percussion instruments. Prerequisite: Mathematics 111, 112, or 118, or equivalent. 3 hours or $\frac{3}{4}$ unit.
303. **Musical Acoustics, II.** Acoustics of the voice; speech formants; intervals, scales, tuning, and temperament; auditorium and room acoustics; microphones and loudspeakers, electronic sound reinforcement, and feedback problems; sound recording and reproduction; and sound analysis and synthesis by computer. Prerequisite: Music 302. 3 hours or $\frac{3}{4}$ unit.
304. **Contemporary Compositional Techniques.** Studies in specialized areas of composition for advanced undergraduates and graduates majoring in composition-theory. May be elected by others with consent of instructor. Prerequisite: Music 104, 106, or 109, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
306. **Composition.** Work in original composition including the small and large homophonic forms. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit.
307. **Counterpoint of the Fifteenth and Sixteenth Centuries.** Analysis and writing in the principal contrapuntal styles of the fifteenth and sixteenth centuries; familiarization, through study and singing, with the styles of Dunstable, Dufay, Obrecht, Okeghem, Gombert, Des Pres, Lassus and Palestrina; and writing based on the results of the study of these composers' works. Prerequisite: Junior standing in music or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in 1975-76 and in alternate years.
308. **Analysis of Musical Form.** Intensive study of representative compositions of the sixteenth through the twentieth centuries for structure and form. Prerequisite: Music 104 and 109, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
309. **Electronic Music Techniques.** Introduction to use of electronic music studios; aesthetics of sound composition and compositional techniques; system theory; "classical" sound synthesis and tape manipulation techniques; concept of voltage control and use of voltage-controlled synthesizers; techniques for interaction of live sounds with electronics; and notational problems. Tape composition studies are assigned. Prerequisite: Credit or concurrent registration in Music 302. 3 hours or $\frac{3}{4}$ unit.
310. **Ancient Medieval Music.** A history of music from its origins to about 1400. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
311. **Music in the Renaissance.** A history of music from about 1400 to 1600. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
312. **Music of the Seventeenth Century.** A history of music from about 1600 to 1700. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
313. **Music of the Eighteenth Century.** A history of music from about 1700 to 1800. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
314. **Music of the Nineteenth Century.** A history of music from about 1800 to 1900. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
315. **Music of the Twentieth Century.** A history of music from about 1900 to the present. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
316. **Introduction to Music of the World's Cultures.** Same as Anthropology 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to methods of collecting and studying music in nonliterate, folk, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
317. **Area Studies in Ethnomusicology.** Same as Anthropology 315. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cul-

- tures, or American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 12 hours or 2 units.
318. **History of Performance Practices, I.** Study of musical performance from about 900 to 1650 A.D.; discussion of musical instruments, makeup of instrumental and vocal ensembles, etc., supplemented by demonstration performances of selected works using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
319. **History of Performance Practices, II.** Study of musical performance from 1600 to 1750 A.D.; discussion of musical instruments, ornamentation, basso, continuo, etc., supplemented by demonstration performances using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
320. **Proseminar.** Special preparation in specialized fields of musicology, theory and composition, and music education. Prerequisite: Senior or graduate standing in music or music education; consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
321. **Proseminar in Musicology.** Practical introduction to research in musicology, devoted each time to intensive study of a selected topic, including use of primary source materials, lectures, and reports. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit. May be repeated to a maximum of 2 units.
323. **Opera Production, I.** Helps interested students on the graduate level study the problems of the lyric stage; investigation of and practice with casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics. Prerequisite: Music 265 and 381; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
324. **Opera Production, II.** Helps interested students on the graduate level study the problems of the lyric stage; investigation of and practice with casting methods, program selections, production procedures, stage direction, coaching methods, and opera dramatics. Prerequisite: Music 323. 3 hours or $\frac{1}{2}$ unit.
325. **Introduction to Musicology, I.** Survey of the discipline of musicology, its scope, and its history with bibliographical studies and sample problems for investigation. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or $\frac{1}{2}$ unit).
326. **Introduction to Musicology, II.** Continuation of a survey of the discipline of musicology; special attention to class projects in systematic musicology and to the philosophy of music history. Prerequisite: Music 325 or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or $\frac{1}{2}$ unit).
327. **Urban Popular Music.** Introduction to the world's popular music; emphasis on its role in society, based on American, European, Latin American, and non-Western repertoires. Prerequisite: Music 130 or equivalent, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
330. **Applied Music Pedagogy.** Survey of techniques, practices, and materials; presentation of group and individual instruction; an approach to teaching problems, tone production, musical styles, and interpretation for various age levels; and actual teaching experience under faculty supervision. Required of applied music majors in piano, voice, and string instruments. Prerequisite: Junior standing in music or consent of instructor. 2 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 4 hours or 1 unit.
334. **The Music of America, I.** Study of folk, popular, and art music in America from the time of the first European settlers through the middle of the nineteenth century; psalmody, early opera and concert life, African and European folk music, the singing school, music of European immigrants, and the roots of jazz. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
335. **The Music of America, II.** Study of chamber, choral, and orchestral music written by American composers from 1850 to the present; jazz and its offshoots; folk and popular music; and experimental music in America. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

- 336. Music in Latin America.** Studies in the history of music in Latin America from colonial times to the present, including its cultural and social background. Each semester is devoted to a specific area, e.g., Caribbean America and Venezuela, Colombia and the Andean nations, Brazil and the River Plate nations. A reading knowledge of Spanish or Portuguese is recommended. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 6 hours or 1 unit.
- 340. Instrumental Clinic and Band Pageantry.** Study of the peculiarities of the individual instruments, criteria for selection, and accepted teaching methods and procedures for each instrument. Band pageantry deals with formation designing, charting and show continuity, marching fundamentals, and special problems. Prerequisite: Advanced undergraduate or graduate standing with major work or experience in band or orchestra. 2 hours or $\frac{1}{2}$ unit.
- 342. Percussion Methods.** Designed primarily for teachers of school music who may or may not be percussion performers, but who wish to teach percussion and initiate such a program in the schools. Prerequisite: Senior or graduate standing in music education; Music 174 and 257, or equivalent. 3 hours or $\frac{1}{2}$ unit.
- 343. Tests and Measurement in Music Education.** Construction, design, appraisal, and use of measurement devices for music teaching and research. Prerequisite: Consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
- 344. Methods of String Class Teaching.** Designed primarily for teachers of school music who are not performers on a stringed instrument yet would like to be able to teach string classes and start an orchestral program in the schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
- 345. Teaching Techniques of Music Theory.** Teaching materials, methods, texts, and pedagogical sequence are discussed and analyzed, including an intensive survey of the structural materials normally covered during the first two years of collegiate study. Prerequisite: Music 300 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 346. Workshop in Music Education.** Development of essential facts, attitudes, and principles through a consideration of problems encountered in music education. Parallel with this study is the preparation of resource materials for music programs in elementary and secondary schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 2 units. Offered in the summer session only.
- 347. Teaching of Woodwind Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session of 1974 and in alternate years.
- 348. Teaching of Brass Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session of 1974 and in alternate years.
- 349. Music in Early Childhood.** Same as Home Economics 349. Detailed consideration of the music program in nursery schools, kindergarten, and the primary grades; topics include the nature of early musical responses, objectives, experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate level in music education or child development. 2 hours or $\frac{1}{2}$ unit.
- 350. Advanced Ensemble Music.** Selected projects in the study and performance of ensemble literature, including the areas of operatic, instrumental, and vocal-choral music and accompanying. Prerequisite: Registration in applied music at the 300-level; consent of instructor. 2 hours or $\frac{1}{2}$ unit (summer session, 1 hour or $\frac{1}{4}$ unit).
- 355. Musical Theatre.** Same as Theatre 355. Study of musical theatre and its scores and librettos; consideration of production problems, including those of choreography, scen-

ery, and costume design; and the planning and production of a musical play or score. Prerequisite: Junior standing and consent of instructor. 3 hours or ½ unit.

360. **Advanced Group Instruction in Piano, I.** A comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: sight reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (12 hours completed) or Music 163, and Music 104 and 109, or equivalent; consent of instructor. 2 hours or ½ unit.
361. **Advanced Group Instruction in Piano, II.** Continuation of Music 360. Comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: sight reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (12 hours completed) or Music 163; Music 104 and 109 or equivalent; Music 360 or equivalent and consent of instructor. 2 hours or ½ unit.
366. **Vocal Repertoire, I.** To be taken with Music 381. Study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera; supplements the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice or consent of instructor. 1 hour.
367. **Vocal Repertoire, II.** To be taken with Music 381. Study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera; supplements the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice; consent of instructor. 1 hour.
377. **Principles of Accompanying.** Grasp of the fundamental principles of accompanying singers and instrumentalists; practical experience in accompanying; and facility in sight reading for keyboard performers. Prerequisite: Advanced undergraduate or graduate standing in music or music education and consent of instructor. 4 hours or 1 unit (summer session, 2 hours or ½ unit).

Note: Music 378 through 398 (applied music) have the following 803 prerequisite: For students in the Bachelor of Music curriculum, 804 junior standing in the major applied music subject; for students 805 in music education, completion of the curricular requirement 806 in the major applied music subject; and for students in other 807 colleges of the University, completion of four semesters in 808 comparable applied music course at the 100-level. 809

378. **Guitar.** Private instruction in guitar on the advanced undergraduate and graduate levels; predominantly classical. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
379. **Harpischord.** Private instruction in harpischord on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
380. **Piano.** Private instruction in piano on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
381. **Voice.** Private instruction in singing on the advanced undergraduate and graduate level. 2 or 3 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
382. **Organ.** Private instruction in organ on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
383. **Violin.** Private instruction in violin on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
384. **Viola.** Private instruction in viola on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
385. **Cello.** Private instruction in violoncello on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).
386. **String Bass.** Private instruction in string bass on the advanced undergraduate and graduate level. 2 or 4 hours, or ½ or 1 unit (summer session, 1 or 2 hours, or ¼ or ½ unit).

387. **Flute.** Private instruction in flute on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
388. **Clarinet.** Private instruction in clarinet on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
389. **Oboe.** Private instruction in oboe on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
390. **Bassoon.** Private instruction in bassoon on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
391. **Cornet and Trumpet.** Private instruction in cornet and trumpet on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
392. **French Horn.** Private instruction in French horn on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
393. **Trombone.** Private instruction in trombone on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
394. **Baritone.** Private instruction in baritone on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
395. **Tuba.** Private instruction in tuba on the advanced undergraduate and graduate level. 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
396. **Percussion.** Private instruction in percussion on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
397. **Harp.** Private instruction in harp on the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
398. **Saxophone.** Private instruction in saxophone on the advanced undergraduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
400. **Advanced Instrumentation: Chamber and Symphonic.** Orchestration for chamber and symphony orchestras; works of classical, romantic, and modern composers. Prerequisite: Undergraduate instrumentation. $\frac{1}{2}$ or 1 unit.
401. **Advanced Instrumentation: Band.** Arrangement for the concert band of works from orchestra, organ, and chamber music by composers of the classical, romantic, and modern periods. Prerequisite: Undergraduate instrumentation. $\frac{1}{2}$ or 1 unit.
402. **Analysis in Relation to Performance and Interpretation, I.** A unifying course in the structure of music, in which analysis is related to the performance and understanding of music; course material drawn from standard literature from the Renaissance to the present day with emphasis on the smaller forms. Prerequisite: Music 104 or equivalent; consent of instructor. 1 unit.
405. **Individual Topics in Music Theory.** Studies in specialized areas of analysis, theory systems, and aesthetics for theory-composition majors. Prerequisite: Graduate standing in music; consent of instructor. $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 3 units.
406. **Composition.** Advanced study of contrapuntal forms; study of contemporary melodic and harmonic practices; and original work in advanced composition. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
410. **History of Music Theory, I.** The development of theoretical concepts from antiquity through the Renaissance; a study of selected theoretical treatises written before 1550. Prerequisite: Graduate standing in musicology or composition, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
411. **Introduction to Ethnomusicology.** Comprehensive survey of concepts, problems, and methods of research in non-Western and folk music. Prerequisite: Graduate standing in musicology or consent of instructor. 1 unit.
412. **History of Musical Aesthetics, I.** Survey of the principal philosophies of music from Pythagoreanism to the humanistic period, their historical backgrounds, and their relation to musical styles. Prerequisite: Graduate standing in music. $\frac{1}{2}$ or 1 unit. Offered in 1975-76 and in alternate years.

413. **History of Musical Aesthetics, II.** Survey of the principal philosophies of music, their historical backgrounds, and their relation to musical styles from the seventeenth century to the present day. Prerequisite: Music 412. $\frac{1}{2}$ or 1 unit. Offered in 1975-76 and in alternate years.
414. **Notation, I.** History of notation from its beginning to 1400. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
415. **Notation, II.** History of notation from 1400 to 1600, including instrumental tablatures. Prerequisite: Music 414 or consent of instructor. $\frac{1}{2}$ unit.
417. **History of Instrumental Music from 1600 to 1750.** Study of instrumental music in the baroque era. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. Offered in 1975-76 and in alternate years.
418. **The Origins and the History of Opera up to Gluck.** The antecedents of opera in the sixteenth century; social, cultural, intellectual forces leading to its development; study of scores, librettos, and scenography; and readings on performance practices, theory, and aesthetics of opera. The principal composers covered are Monteverdi, Cavalli, Cesti, Lully, Rameau, Blow, Purcell, Scarlatti, Handel, and Gluck. $\frac{1}{2}$ or 1 unit. Prerequisite: Music 312 or consent of instructor.
419. **The History of Opera from Mozart to the Present.** A detailed examination of stylistic and structural developments in opera after Gluck, with special reference to representative works from Mozart to Schoenberg viewed in relation to the general musical and cultural background of their time and place of origin. Prerequisite: Music 312 and 313, or consent of instructor. $\frac{1}{2}$ or 1 unit.
420. **Seminar in Music Literature.** Intensive study of outstanding works selected from all fields of music literature. Required of all students (except those in choral music) enrolled in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
421. **Research in Music Education.** Introduction to problems and methods of research in music education. Required of all candidates for the Doctor of Education in music education. Prerequisite: Graduate standing in music education or consent of instructor. $\frac{1}{2}$ or 1 unit.
422. **Seminar in Theory of Music.** Intensive study of selected topics in the fields of music theory, history of theory, and history of musical materials. Prerequisite: Graduate standing in music theory or consent of instructor. $\frac{1}{2}$ or 1 unit.
423. **Seminar in Musicology.** Problems in historical and systematic musicology; discussions of special problems and reports on individual research. Prerequisite: Graduate standing in musicology and Music 321, or consent of instructor. 1 unit.
424. **Seminar in the Works of a Selected Composer.** A seminar devoted to intensive historical and analytical study of the works of important composers; each semester devoted to one composer, e.g., Bach, Beethoven, Handel, Haydn, Mozart, or Wagner. Prerequisite: Music 213 and 214; two of the following: Music 310, 311, 312, 313, or 315, or equivalent. 1 unit (summer session, $\frac{1}{2}$ unit). May be repeated for a maximum of 2 units.
425. **Readings in Musicology.** Individual guidance in intensive readings in the literature of one or more subdivisions of the field of musicology, selected in consultation with the instructor and in accordance with the needs and interests of the student. Prerequisite: Graduate standing in musicology; consent of instructor. $\frac{1}{2}$ or 1 unit (summer session, $\frac{1}{2}$ unit).
426. **Choral Literature, I.** Survey of choral and vocal ensemble repertoire from the Middle Ages to 1750. Prerequisite: Open to graduate music students by consent of instructor. $\frac{1}{2}$ unit.
427. **Choral Literature, II.** Survey of choral repertoire from 1750 to the present. Prerequisite: Open to graduate music students by consent of instructor. $\frac{1}{2}$ unit.
428. **Problems and Methods.** Introduction to methods in research and stylistic criticism and to bibliographic aids, editions, and editing of music, as related to the work of the musician and composer. Reports of bibliographic problems and on individual projects are

presented orally and in writing. Required of all students in the Master of Music program, except those majoring in musicology. 1 unit.

429. **Historical Studies in Twentieth-Century Music.** A seminar in contemporary music, with emphasis on the historical foundations of current trends in musical composition. Prerequisite: Music 315 or 422, or equivalent. $\frac{1}{2}$ to 1 unit (summer session, $\frac{1}{2}$ unit). May be repeated to a maximum of 2 units.
430. **Advanced Orchestra Conducting and Literature.** Intensive study of conducting techniques and problems related to standard orchestral literature; survey of materials for school and community orchestras. Prerequisite: Previous conducting experience. 1 unit.
431. **Advanced Band Conducting and Literature.** Study of problems and techniques of band conducting; survey of literature for the concert band. Prerequisite: Bachelor's degree with major work or experience in band and/or orchestra; consent of instructor. 1 unit.
432. **Advanced Choral Techniques, I.** An intensive laboratory approach to the development of advanced techniques necessary for working effectively with choral ensembles. Prerequisite: Graduate standing in music. 1 unit.
433. **Advanced Choral Techniques, II.** An intensive survey of choral literature with laboratory organization for reading, conducting, and interpreting choral music of all periods, styles, and voice arrangements. Prerequisite: Graduate standing in music, Music 432 or equivalent, or consent of instructor. 1 unit.
434. **Piano Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
435. **Vocal Literature.** Study of solo song in larger works, and solo art song. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
436. **Organ Literature.** An intensive study of organ literature from Bach to the present; includes the music itself, recordings, and collateral readings. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
437. **String Instrument Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
438. **Wind Instrument Literature.** Survey at the graduate level of the field of solo and ensemble wind literature; includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. 1 unit. May be repeated for a maximum of 2 units.
439. **Percussion Instruments Literature.** Survey and analysis of the field of solo and ensemble percussion literature; includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. Prerequisite: Graduate standing in music; consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
440. **Foundations and Principles of Music Education, I.** Consideration of the historical and philosophical foundations of music education; the application of the principles of education to the music program; and major emphasis on current trends in educational thought and their implications for music education. Prerequisite: Graduate standing in music education; consent of instructor. $\frac{1}{2}$ or 1 unit.
441. **Foundations and Principles of Music Education, II.** Consideration of the psychological foundations of music education; the application of the principles of education to the music program; and major emphasis on current trends in educational thought and their implications for instruction, supervision, administration, and evaluation in music education. Prerequisite: Graduate standing in music education; consent of instructor. $\frac{1}{2}$ or 1 unit.
442. **The General Music Program in Secondary Schools.** Detailed consideration of the general music program, its objectives, organization, and operation; special attention to materials and methods of teaching. Prerequisite: Graduate standing in music education. $\frac{1}{2}$ or 1 unit.

443. **Administration and Supervision of Music Education.** Deals with the functions of supervisors and directors of music education in administering music programs in elementary and secondary schools. Prerequisite: Graduate standing in music or music education. ½ or 1 unit.
444. **The General Music Program in Elementary Schools.** Detailed consideration of elementary general music, its objectives, organization, and operation; special attention to materials and methods of teaching. Prerequisite: Graduate standing in music education. ½ or 1 unit.
445. **Music in Higher Education.** An orientation to the organization, teaching, and administration of music in the college and university. Prerequisite: Graduate standing in music or music education. ½ or 1 unit.
446. **Seminar in Experimental Music, I.** Survey of contemporary electronic music, computer music, and related types of music; discussion of relevant music theory. Prerequisite: Music 303 or consent of instructor. ½ unit.
447. **Seminar in Experimental Music, II.** Continuation of Music 446. Prerequisite: Music 446 or consent of instructor. ½ unit.
448. **Computer Music.** Representation of sound signals in a digital computer; methods for input and output of sounds to and from a computer; sound synthesis programs; synthesis of simple musical structures; use of graphics; processing of live sounds by computer; editing and retrieval; fidelity of computer-produced sounds; and hybrid analog/digital computers. Prerequisite: Music 302 or equivalent; concurrent registration in Computer Science 101 or equivalent. ½ unit.
450. **History of Vocal Ensemble and Choral Music, I.** Critical and analytic study of vocal and choral ensemble music from the Middle Ages to 1750. Prerequisite: Music 426 and 427, or consent of instructor. 1 unit (summer session, ½ unit).
451. **History of Vocal Ensemble and Choral Music, II.** Critical and analytic study of vocal and choral ensemble music from 1750 to the present. Prerequisite: Music 450 or consent of instructor. 1 unit (summer session, ½ unit).
452. **Choral Conducting Project.** Required of candidates for the degree of Master of Music with choral music option during the final semester in residence; includes participation in a graduate choral conducting laboratory and preparation of a choral ensemble for public performance. Prerequisite: Music 432 and consent of instructor. ½ unit.
454. **Advanced Choral Performance Techniques.** Study of performance problems and musical analysis of choral music with techniques of preparation and rehearsal from the various style periods: Renaissance, baroque, classic-romantic, and contemporary. Prerequisite: Admission into the Doctor of Musical Arts choral music program, or the equivalent background in other doctoral degree programs. ½ unit. May be repeated to a maximum of 2 units.
477. **Advanced Accompanying.** Grasp of the fundamental principles of accompanying singers and instrumentalists, practical experience in accompanying, and facility in sight reading for keyboard performers. Prerequisite: Graduate standing in music or music education and/or consent of instructor. 1 unit. May be repeated to a maximum of 3 units.
480. **Piano.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. ½ or 1 unit.
481. **Voice.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. ½ or 1 unit.
482. **Organ.** Selected studies from the masterworks of organ literature. Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. ½ or 1 unit.
483. **String Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. ½ or 1 unit.
484. **Wind Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. ½ or 1 unit.

485. **Percussion Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
489. **Doctoral Projects.** Special projects for candidates for the Doctor of Musical Arts; open only to students in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 0 to 3 units.
499. **Thesis Research.** Research in special projects. Prerequisite: Consent of instructor. 0 to 4 units.

NAVAL SCIENCE

Head of Department: Captain C. Withers

Department Office: Room 239 Armory, Champaign

100. **Naval Science Laboratory.** A noncredit course designed to give the Naval ROTC student, through practical application, a better grasp of the naval science subjects taught in the classroom and a working knowledge of close order drill. 0 credit.
111. **Principles of Naval Organization and Management.** Naval organization and management practices examined within the context of American social and industrial organization and practice; command and control, organization for logistics, service and support, functions and services of major components of the Navy and Marine Corps, and shipboard organization; and emphasis on management and leadership functions. Prerequisite: Approval of Professor of Naval Science; concurrent registration in Naval Science 100. 3 hours.
112. **Introduction to Naval Ship Systems.** Study of ship compartmentation, propulsion systems, auxiliary power systems, interior communications, and ship control; types, structure, and purpose of naval ships; and examination of elements of ship design and ship stability. Prerequisite: Naval Science 111 or consent of instructor. 3 hours.
121. **Naval Ships Systems, II.** Introduction to concepts of naval weapons systems, their capabilities and limitations, and their individual and complimentary roles in a wide variety of offensive and defensive situations. Prerequisite: Credit or concurrent registration in Physics 102 or equivalent, and one course in computer science, or consent of instructor. 3 hours.
122. **American Military Affairs.** An introductory survey of military affairs in the United States from the American Revolution to the present; emphasis on the evolution of the American military establishment, and international and domestic considerations leading to American involvement in international conflicts. Prerequisite: Sophomore standing in NROTC Program or consent of instructor. 3 hours.
231. **Navigation and Naval Operations, I.** Provides the student with an understanding of the theory and techniques of the three types of marine (nautical) navigation: piloting, electronic, and celestial. Prerequisite: Junior standing in NROTC Program; concurrent registration in Naval Science 100, or consent of instructor. 3 hours.
232. **Navigation and Naval Operations, II.** Designed to give an understanding of the concepts and use of relative motion principles, international maritime law and the rules of the nautical road, and the fundamentals of U.S. fleet organization, communication, and operations. Prerequisite: Junior standing in NROTC Program; concurrent registration in Naval Science 100, or consent of instructor. 3 hours.
241. **Naval Weapons Systems.** Introduction to the concept of weapons systems and the linear analysis of ballistics and weapons. Prerequisite: Senior standing in NROTC Program; concurrent registration in Naval Science 100. 3 hours.
242. **Naval Personnel Administration.** Exploration of the sociological structure of the military, the management practices essential to the effective functioning of that organization, and the role of the junior manager. Much of the instruction will be theoretical,

but it will also concentrate in the specific areas of military law and justice, administrative procedures, and applicable personnel management practices, the understanding of which is essential to a well-rounded and qualified officer. Prerequisite: Senior standing in NROTC Program; concurrent registration in Naval Science 100, or consent of instructor. 3 hours.

291. **Evolution of Warfare.** Survey of the evolution of warfare; emphasis on the philosophies and trends which have been significant in land warfare. Prerequisite: Advanced undergraduate standing; concurrent registration in Naval Science 100 or consent of instructor. 3 hours.
293. **History of Amphibious Warfare.** Study of amphibious operations and the evolution of amphibious warfare doctrine and development. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.

NUCLEAR ENGINEERING

Chairman of Program: Professor M. E. Wyman

Program Office: 214 Nuclear Engineering Laboratory, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
302. **Nuclear Power Engineering.** Same as Mechanical Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering; includes such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
312. **Nuclear Power Economics and Fuel Management.** A quantitative analysis of the economic impact of the nuclear power industry; nuclear fuel cycle and capital costs for thermal and fast reactors; optimization of the use of nuclear fuels to provide the lowest energy costs and highest system performance; and comparison between fossil fuel systems, fission systems, and controlled thermonuclear systems. Prerequisite: Junior standing; Mechanical Engineering 302, or Nuclear Engineering 302 or 347, or consent of instructor. 3 hours or 1 unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Same as Electrical Engineering 321. Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems; energy balance; plasma confinement and stability; and recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.
347. **Introduction to Nuclear Engineering.** Nuclear particles and nuclear chain reactions; energy release from fission; classification of nuclear reactors; fast and thermal reactors; reactor theory; slowing down and diffusion of neutrons; radiation shielding; materials of construction; radiation damage; reactor instrumentation, safety, and control; and chemical processing of nuclear materials. Prerequisite: Credit or concurrent registration in Nuclear Engineering 397 or Physics 382, or equivalent. 4 hours or 1 unit.
349. **Fundamentals of Radiation Protection.** Same as Civil Engineering 349. Principles and practice of health physics and radiation protection engineering; includes such topics as principles of dosimetry; sources of ionizing radiation; determination of radiation tolerances; dosimetric instruments; and standards and regulations. Prerequisite: Credit or concurrent registration in Nuclear Engineering 397 or Physics 382. 4 hours or 1 unit.
357. **Nuclear Reactor Safeguards.** Safety problems related to nuclear systems; emphasis on problems concerning nuclear reactors; past nuclear accidents and future prevention; selection of sites; containment of radioactivity; engineered safeguards; safety analysis of operation; legal responsibilities; and public relations. Prerequisite: Junior standing;

Nuclear Engineering 302 or Nuclear Engineering 347, or consent of instructor. 3 hours or 1 unit.

- 388. Nuclear Ceramics.** Same as Ceramic Engineering 388. Study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor; discussion of material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in nonfissile ceramics, and nuclear carbon, graphite, and nonfuel ceramic isotope utilization. Prerequisite: Chemistry 245 or Physics 383, or consent of instructor. 3 hours or 1 unit.
- 397. Radiochemistry.** Same as Chemistry 397. Properties of radioactive nuclei; nature of radioactivity; nuclear structure; nuclear reactions; interactions of radiations with matter; chemical aspects of radioactivity work; and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 398. Radiochemistry Laboratory.** Same as Chemistry 398. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. One laboratory and one discussion period per week. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 401. Fundamentals of Nuclear Engineering.** A lecture and problem course to provide background for further work in nuclear engineering; problems in materials, heat transfer, and fluid flow; and special emphasis on basic ideas and the mathematical similarity of problems in heat transfer, fluid flow, and neutron diffusion. Prerequisite: Mathematics 345 or equivalent; credit or concurrent registration in Nuclear Engineering 397 or Physics 382, or equivalent. 1 unit.
- 411. Nuclear Reactor Heat Transfer.** Selected topics in nuclear reactor heat transfer: thermal analysis of fuel elements under steady and transient operation; convective energy transport from reactor cores; two-phase flow and boiling in reactor cores; and liquid metal coolant systems. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
- 421. Nuclear Concepts.** Selected topics in low-energy nuclear physics of general interest to the nuclear engineering field; nuclear reactions; cross sections; slowing down and interactions with matter; decay theory; and nuclear forces. Prerequisite: Credit in a nuclear physics course such as Nuclear Engineering 397 or Physics 382. 1 unit.
- 422. Controlled Fusion Systems.** Same as Electrical Engineering 422. Development of plasma models for fusion analysis; treatment of plasma heating and confinement with applications to current experiments; energy balances and energy extraction, minimum beta configuration, instability criteria, Tokamak machines, pinch systems, and mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
- 425. Nuclear-Electrical Energy Conversion.** Same as Electrical Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection; analysis and applications of direct collection of charged particles; and radiation-induced ionization and excitation theory and applications. 1 unit.
- 431. Nuclear Metallurgy.** Metallurgical principles applied to materials problems in nuclear engineering; includes topics in production of uranium, corrosion, radiation damage, fuel element fabrication, and fuel reprocessing. Prerequisite: Consent of instructor. 1 unit.
- 441. Nuclear Radiation Shielding.** Radiation units and measurement; tolerance limits; interaction of radiation and matter; geometry factors in attenuation; gamma ray and neutron attenuation; moment theory for attenuation; and application to reactors, protective shelters, and space vehicles. Prerequisite: Nuclear Engineering 349; credit or concurrent registration in Nuclear Engineering 455; consent of instructor. 1 unit.
- 451. Reactor Laboratory.** Reactor operation: start-up, changes in power level, and shut-down; reactor instrumentation: subcritical assemblies; flux measurements in core and thermal column; control rod worth measurements; effects of changes in fuel configura-

tions; and activation and neutron-beam experiments. Prerequisite: Nuclear Engineering 347 or consent of instructor. $\frac{1}{2}$ or 1 unit.

454. **Nuclear Engineering Laboratory Investigations.** Individual laboratory investigations in nuclear engineering. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
455. **Reactor Physics, I.** Same as Physics 455. Introduction to the physical concepts of reactor analysis; nuclear cross sections; diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; and computer applications in reactor analysis. Prerequisite: Mathematics 343 and 345, or Nuclear Engineering 347, or consent of instructor. 1 unit.
456. **Reactor Physics, II.** Same as Physics 456. Continuation of Nuclear Engineering 455. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; and digital computer methods. Prerequisite: Nuclear Engineering 455 or consent of instructor. 1 unit.
457. **Methods of Fast Reactor Analysis.** Static and dynamic performance characteristics of fast reactors; multigroup diffusion and transport models for fast power-reactors; construction of multigroup cross-section sets; algorithms for one-dimensional and multidimensional numerical analysis; reactivity coefficients; and fast reactor safety and reliability. Prerequisite: Nuclear Engineering 455. 1 unit.
458. **Nuclear Reactor Engineering.** Development of engineering design phases of the fission chain reactor: reactor materials and radiations; thermal aspects; heat removal; radiation hazards; shielding; reactor performance; controls and instrumentation; types and applications; fuel conversion; and reactor power economics. Prerequisite: Nuclear Engineering 347 or consent of instructor. 1 unit.
460. **Reactor Kinetics.** Discussion of special topics such as response of reactor systems to changes of power demand and reactivity; transfer function analysis, nonlinear problems of reactor dynamics, and reactor stability; fuel cycles; and digital and analog computer methods for solving reactor kinetic problems. Prerequisite: Nuclear Engineering 401; credit or concurrent registration in Nuclear Engineering 455; consent of instructor. 1 unit.
467. **Thermomechanics of Nuclear Reactor Systems.** Same as Theoretical and Applied Mechanics 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal shock and thermal stress-wave propagation; and current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
490. **Special Topics.** Selected areas are considered which are of current interest in research, such as nuclear materials, advanced reactor systems, thermonuclear problems, digital computer methods in nuclear engineering, and advanced topics in reactor theory. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit.
495. **Nuclear Engineering Problems.** Individual study in areas of nuclear engineering and closely related fields not covered by regular course offerings. The work is carried out under the supervision of a member of the staff. Prerequisite: At least 3 units of graduate work; consent of instructor. $\frac{1}{4}$ to 2 units.
497. **Seminar in Nuclear Science and Engineering.** Lectures and discussions on current work in research and development in nuclear engineering and related fields by staff, advanced students, and visiting lecturers. 0 credit.
499. **Thesis Research.** 0 to 4 units.

NUTRITIONAL SCIENCES

Chairman of Committee: Professor H. H. Draper

Program Office: 567 Bevier Hall, Urbana

- 400. Nutritional Sciences Seminar.** Discussions on current problems in nutritional sciences. Required of all graduate students in the nutritional sciences program. Prerequisite: Animal Science 420. $\frac{1}{4}$ unit.
- 410. Current Topics in Nutritional Research.** Same as Food Science 410 and Dairy Science 410. A discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350; an upper-division course in nutrition. $\frac{3}{4}$ unit.
- 411. Chemistry of Nutritional Processes.** Same as Food Science 411 and Dairy Science 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350; an upper-division course in nutrition. 1 unit.
- 493. Individual Topics in Nutrition.** For students majoring in nutritional sciences who wish to undertake individual studies of a nonthesis nature in problems or topics not covered in other courses; may be taken under the direction of any member of the nutritional sciences faculty, with the exception of the student's own thesis adviser. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
- 499. Thesis Research.** 0 to 4 units (summer session, 0 to 2 units).

OCCUPATIONAL THERAPY

Program Adviser: B. Loomis

Program Office: 1115 West Oregon Street, Urbana

- 100. Occupational Therapy Orientation.** History and development of professional aspects of occupational therapy; its scope and relation to allied professions; and its function in the field of physical and mental adjustment. Prerequisite: Registration in occupational therapy curriculum. 2 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.

PERSIAN

(See Asian Studies)

PETROLEUM ENGINEERING

(See Metallurgy and Mining Engineering)

PHILOSOPHY

Chairman of Department: Professor J. D. Wallace

Department Office: 105 Gregory Hall, Urbana

101. **Introduction to Philosophy.** 3 hours.
102. **Logic.** Reasoning, detection of fallacies, and evidence. 3 hours.
103. **Ethics and Social Policy.** An examination of the moral aspects of social problems, and a survey of ethical principles formulated to validate social policy. Credit is not given for both Philosophy 103 and 105. 4 hours.
104. **Philosophy of Democracy.** An examination of the philosophical bases of democracy and some of its opponents. 4 hours.
105. **Moral Ideas and Practice.** Credit is not given for both Philosophy 105 and 103. 3 hours.
110. **World Religions.** Same as Religious Studies 110. Survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. 3 hours.
195. **Freshman Seminar.** Investigation of selected fundamental topics of philosophical inquiry, as announced each semester. Prerequisite: Freshman James Scholar. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
210. **Ethics.** Problems in ethical theory; the nature of right and wrong, justice, conscience, moral feelings, etc. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Religious Studies 230. A critical study of theories about the nature of religion. 3 hours.
270. **Philosophy of Science.** Investigation of the nature of scientific knowledge by examining archetypal examples from physical science (e.g., Ptolemaic and Copernican astronomy); nature of scientific truth, validation of theories, nature of scientific theories, evolution of theories, experimental procedure, role of presuppositions, scientific revolutions, etc. 3 hours.
291. **Reading Course.** Readings in selected philosophical topics. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to juniors and seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. May be repeated for a maximum of 4 hours.
292. **Thesis.** Special training in philosophical investigation. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. May be repeated for a maximum of 4 hours.
295. **Senior Seminar.** Seminar on selected philosophical topics. Prerequisite: Open to senior philosophy majors with a general grade-point average of 4.0 only with consent of instructor. 3 hours. May be repeated for a maximum of 6 hours.
303. **History of Ancient Philosophy.** A survey primarily of the Greeks, dealing with such topics as knowledge, metaphysics, ethics, theory of nature, and mysticism. 4 hours or 1 unit.
304. **History of Medieval Philosophy.** Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **History of Modern Philosophy.** 4 hours or 1 unit.
307. **History of Modern Philosophy.** Bacon, Hobbes, Locke, Berkeley, and Hume. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
308. **History of Modern Philosophy.** Descartes, Spinoza, Leibniz, and Kant. Philosophy

- 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
309. **The Philosophy of Plato.** Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit.
310. **The Philosophy of Aristotle.** An intensive study of major works in Aristotle or of some aspect of his philosophy. Prerequisite: Philosophy 101 or 303. 3 hours or 1 unit.
311. **Philosophic Ideas of the Nineteenth Century.** Prerequisite: One course in philosophy (preferably Philosophy 101 or 306). 3 hours, or $\frac{3}{4}$ or 1 unit.
312. **Classical Modern Philosophers.** Intensive study of one, or in special cases, two major philosophers of the period 1600-1900, e.g., Descartes, Hume, Kant, or Hegel. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
313. **American Philosophy.** The history of philosophy in America from colonial times to the present. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
315. **European Philosophy Since 1900.** Introduction to the major recent philosophical movements in Europe, such as phenomenology, existentialism, philosophical anthropology, and neo-Marxism. 3 hours or 1 unit.
316. **Anglo-American Philosophy Since 1900.** Introduction to the major philosophical developments in England and America in the present century, focusing on such writers as G. E. Moore, Bertrand Russell, A. J. Ayer, Ludwig Wittgenstein, and W. V. Quine. Prerequisite: One course in philosophy. 3 hours or 1 unit.
317. **Scientific Thought, I.** An historical and critical survey of the development of science and its philosophical interpretation to the death of Newton. 3 hours or 1 unit.
318. **Scientific Thought, II.** An historical and critical survey of the development of science and its philosophical interpretation from the death of Newton to the early twentieth century. Prerequisite: Philosophy 317. 3 hours or 1 unit.
321. **Ethics and Value Theory.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
322. **Recent Developments in Ethics.** Ethical theories of the last fifty years; intuitionism, naturalism, pragmatism, emotivism, existentialism, and analytic ethics. Prerequisite: Philosophy 103, 105, or 321. 3 hours, or $\frac{3}{4}$ or 1 unit.
323. **Philosophy of Art.** 3 hours, or $\frac{3}{4}$ or 1 unit.
324. **Philosophy of Religion.** Same as Religious Studies 362. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their modern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
325. **Philosophy of Mind.** Philosophical problems arising in connection with mental phenomena; the relation of mind and body; free will and determinism; our knowledge of other minds; and the self and personal identity. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
326. **Metaphysics.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
328. **Philosophy of Science.** Study of some philosophical problems that have developed from modern sciences. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
329. **The Philosophy of Social Science.** Same as Anthropology 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
330. **Theory of Knowledge.** The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism; and other selected contemporary topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Analytic Philosophy.** Advanced treatment of problems of knowledge and method, and introduction to contemporary techniques of philosophical analysis; meaning and verification; inductive and deductive method; perceptual knowledge; certainty; and other selected topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Perception and Knowledge.** A systematic study of basic problems in the philosophy of perception; perceiving as a mental state; the objects of perception; sensing, sensation,

and sensedata; perception and the external world; and perception as the basis for empirical knowledge. Traditional empiricist philosophies of perception are examined, and contemporary criticisms and defenses are assessed. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.

333. **Symbolic Logic.** Study of the elementary principles of symbolic analysis as applied to logical problems. 3 hours, or $\frac{3}{4}$ or 1 unit.
334. **Symbolic Logic.** A general study of the more refined methods of symbolic analysis as applied to logical problems; particular attention to proof procedures as they relate to the question of consistency and completeness. Prerequisite: Philosophy 333. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Social Philosophy.** Selected topics from the nature of social organization, nature and convention, utility, justice, equality, liberty, rights, and duties. Prerequisite: Philosophy 103, 105, or 321, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **Philosophy of Law and of the State.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
337. **Semantics.** An investigation of semantical concepts such as denoting and truth; a study of the functions of language; definition, meaning and verification, and semantical paradoxes. Prerequisite: A course in logic. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **Philosophies of Language.** Same as Linguistics 338. Study of the development of philosophical problems about language and their treatment from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
339. **Philosophy of Mathematics.** Introduction to some of the main philosophical problems and contemporary viewpoints concerning mathematical concepts, mathematical methods, and the nature of mathematical truths; the concept of infinity; conventionalism and formalism; the distinction between analytic and synthetic truths; necessity; mathematics and the problem of universals; and other related topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **The Philosophy of Alfred North Whitehead.** Examination of the mature thought of A. N. Whitehead, primarily as contained in *Process and Reality* and *Adventures of Ideas*, taking into account both the cosmological scheme and the application of his technical philosophy to social philosophy, to ethics, and to philosophy of religion. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
341. **Existential Philosophy.** Study of a selection of the major writings of the more important existential philosophers, e.g., Heidegger, Jaspers, and Sartre. Prerequisite: One course in philosophy (preferably Philosophy 311), or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
343. **Phenomenology.** Study of the development of phenomenology from Husserl to the present. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
345. **Marxist Philosophy.** Examination of the philosophical writings of a number of Marxist writers, from Marx himself to such neo-Marxists as Schaff, Petrovic, Sartre, and Marcuse. 3 hours, or $\frac{3}{4}$ or 1 unit.
353. **Metamathematics, I.** Formal mathematical systems and their semantics: sentential first-order predicate calculus; predicate calculus with identity; formal semantics and model theory of these systems; consistency and completeness theorems; Gödel completeness theorem; Lowenheim-Skolem theorem; and compactness theorem. Intended primarily for philosophy majors. Prerequisite: Philosophy 102 or graduate standing, or consent of instructor. 3 hours or 1 unit.
354. **Metamathematics, II.** Continuation of Philosophy 353. Elementary arithmetics; Craig's theorem and Beth definability results; arithmetization and recursive enumerability; recursive functions; Church's thesis; Church's theorem; Gödel incompleteness theorems and their extensions; Tarski's truth theorem; alternative approaches to recursive function theory; and selected additional topics. Intended primarily for philosophy majors. Prerequisite: Philosophy 353 in the previous semester, or consent of instructor. 3 hours or 1 unit.

355. **Inductive Logic.** Philosophical foundations of probability theory; formal development and applications of the frequency and logical, and subjective interpretations to the philosophical problems of induction and confirmation. Prerequisite: Philosophy 333 or 353, or Mathematics 410, or consent of instructor. 3 hours or 1 unit.
361. **Comparative Religion.** A comparative study of classical high religions. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Contemporary Religious Thought.** Same as Religious Studies 369. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "neoorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
369. **Indian Philosophy.** Same as Religious Studies 368. Survey of Indian philosophy; emphasizes readings in the fundamental texts of Indian thought; and develops basic familiarity with the wide range of Indian philosophies and theologies. Prerequisite: Either a previous course in philosophy, or Religious Studies 297, or any of History 387, 393, 397, 398, or 399. 3 hours, or $\frac{3}{4}$ or 1 unit.
371. **Philosophy of Science II: Contemporary Issues.** A comprehensive survey of the main developments in philosophy of science this century; concentration on the views of logical positivism, subjectivism, and scientific realism; and topics including the nature of theories, laws and counter-factuals, inductive logic and confirmation theory, experimental methodology, concept formation, and scientific revolutions. Prerequisite: Philosophy 270 or consent of instructor. 3 hours or 1 unit.
401. **Seminar in Ancient Philosophy.** 1 unit. May be repeated for credit.
403. **Seminar in Medieval Philosophy.** 1 unit. May be repeated for credit.
405. **Seventeenth-Century Continental Thought (Descartes, Spinoza, Leibniz).** Study of the basic philosophical works of the three leading continental thinkers of the century. 1 unit. May be repeated for credit.
407. **British Empiricism.** 1 unit. May be repeated for credit.
408. **Seminar in Kant.** 1 unit. May be repeated for credit.
409. **American Philosophy.** Major American philosophers and movements. Reports and discussions. 1 unit. May be repeated for credit.
410. **Seminar in Nineteenth-Century Philosophy.** 1 unit. May be repeated for credit.
411. **Seminar in Ethical Theory.** 1 unit. May be repeated for credit.
412. **Seminar in Social Philosophy.** A seminar designed to study special problems in social philosophy; particular attention given to the contributions of the social sciences to social philosophy. To be offered with varying topics. 1 unit. May be repeated for credit.
413. **Logical Theory.** Logical syntax and semantics. Prerequisite: A course in logic or consent of instructor. 1 unit. May be repeated for credit.
415. **Seminar in Metaphysics.** Intensive study of a selected topic of major importance in the field of metaphysics. 1 unit. May be repeated for credit.
417. **Seminar in the Philosophy of Science.** Various problems arising from specific studies in philosophy pertaining to science and vice versa. To be offered with varying topics. 1 unit. May be repeated for credit.
420. **Seminar in Semantics.** Same as Communications 420. Intensive study of important contemporary contributions in the fields of semantics, analytic philosophy, and the philosophy of language. Prerequisite: Graduate standing in philosophy or equivalent. 1 unit. May be repeated for credit.
421. **Seminar in Contemporary Problems.** Intensive study of selected problems or topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. 1 unit. May be repeated for credit.
423. **Seminar in the Theory of Knowledge.** Selected topics and writings of major importance in the contemporary philosophy of knowledge. 1 unit. May be repeated for credit.
425. **Seminar in the Philosophy of Mind.** Selected topics from major writings in the philosophy of mind. 1 unit. May be repeated for credit.

430. **Seminar in Aesthetics.** Study of selected writings in modern aesthetics. 1 unit. May be repeated for credit.
439. **Seminar in the Philosophy of Mathematics.** Detailed examination of important questions arising from philosophical and logical analyses of mathematics. Prerequisite: Consent of instructor. 1 unit. May be repeated for credit.
483. **Individual Topics.** Individual study and oral and written reports on topics not covered in other courses. Topics and plan of study must be approved by the candidate's adviser and by the staff member who directs the work. $\frac{1}{2}$ or 1 unit (summer session, $\frac{1}{2}$ to 2 units).
499. **Thesis Research.** 0 to 4 units.

PHYSICAL EDUCATION

Head of Department: Professor R. G. Wright

Department Office: 120 Huff Gymnasium, Champaign

100. **Foundations of Physical Activity.** Activities and understanding of the human body relative to physical fitness and sport skill patterns. 1 hour.
101. **Prescribed Exercise.** Prescribed exercise adapted to individual needs, capacities, and interests. Open only to paraplegic and handicapped students. 1 hour. May be repeated to a maximum of 4 hours.
102. **Symbolism and Movement.** Analysis of movement as a science and art, and as a symbolic form of communication; creative exploration of movement as a concomitant element of theater and the concert stage. 1 hour.
103. **Physical Fitness.** Activities and understanding which contribute to the development and maintenance of physical fitness according to social and hygienic standards. 1 hour. May be repeated once for credit if taken in successive semesters.
104. **Weight Training.** Skills and knowledge essential for use of weights for conditioning the body. 1 hour. May be repeated once for credit if taken in successive semesters.
105. **Conditioning and Weight Control.** Activities and understanding which contribute to the development and/or maintenance of physical fitness and a well-proportioned body. 1 to 2 hours. May be repeated once for credit if taken in successive semesters; credit not to exceed a total of 2 hours.
107. **Personal Defense.** Skills and understanding essential for defense against an aggressor, with emphasis on avoiding attack. 1 hour.
110. **Wrestling.** Introductory skills, knowledge, and conditioning essential for collegiate wrestling. 1 hour.
114. **Tumbling.** Introductory skills, knowledge, and conditioning relative to tumbling and free exercise. 1 hour. May be repeated once for credit.
115. **Trampoline.** Introductory skills, knowledge, and conditioning relative to trampolining and tumbling. 1 hour.
117. **Apparatus, I.** Introductory skills, knowledge, and conditioning relative to participation on heavy apparatus. 1 hour.
123. **Target Archery.** Introductory skills, knowledge, and conditioning essential for target shooting. 1 hour.
127. **Angling.** Introductory skills and understanding essential for bait, fly, and spin casting. 1 hour.
134. **Ballroom Dance, I.** Introductory skills and understanding essential for ballroom dance, with emphasis on fox-trot, rhumba, lindy, waltz, cha-cha, and selected fad dances. 1 hour.
135. **American Square Dance.** Introductory skills and understanding essential for square dancing; opportunities for conducting and calling dances. 1 hour.

136. **International Folk Dance.** Introductory skills, knowledge, and conditioning essential for exploring cultural characteristics via the folk dance idiom. 1 hour.
138. **Modern Dance, I.** Introductory skills, knowledge, and conditioning essential for free and creative dance. 1 hour.
143. **Bowling, I.** Introductory skills and understanding essential for bowling. 1 hour.
144. **Golf, I.** Introductory skills and understanding essential for course play, with emphasis on irons. 1 hour.
145. **Figure Skating, I.** Introductory skills, knowledge, and conditioning essential for figure skating. 1 hour.
148. **Track and Field.** Introductory skills, knowledge, and conditioning essential for various track and field events. 1 hour. May be repeated once for credit.
153. **Badminton.** Introductory skills, knowledge, and conditioning essential for badminton. 1 hour.
154. **Foil Fencing.** Introductory skills, knowledge, and conditioning essential for foil fencing. 1 hour.
155. **Handball.** Introductory skills, knowledge, and conditioning essential for four-wall handball. 1 hour.
156. **Racquetball.** Introductory skills, knowledge, and conditioning essential for racquetball. 1 hour.
157. **Squash Racquets.** Introductory skills, knowledge, and conditioning essential for squash racquets. 1 hour.
158. **Tennis, I.** Introductory skills, knowledge, and conditioning essential for court play. 1 hour.
163. **Basketball.** Introductory skills, knowledge, and conditioning essential for basketball. 1 hour.
164. **Volleyball, I.** Introductory skills, knowledge, and conditioning essential for power volleyball. 1 hour.
169. **Rugby Football.** Introductory skills, knowledge, and conditioning essential for offensive and defensive strategies of the game. 1 hour.
171. **Football.** Introductory skills, knowledge, and conditioning essential for football. 1 hour.
172. **Lacrosse.** Introductory skills, knowledge, and conditioning essential for lacrosse. 1 hour.
173. **Soccer.** Introductory skills, knowledge, and conditioning essential for soccer. 1 hour.
174. **Speedball and Speedaway.** Introductory skills, knowledge, and conditioning necessary for speedball and speedaway. 1 hour.
175. **Field Hockey.** Introductory skills, knowledge, and conditioning essential for field hockey. 1 hour.
176. **Ice Hockey.** Introductory skills, knowledge, and conditioning essential for ice hockey. 1 hour.
177. **Baseball.** Introductory skills, knowledge, and conditioning essential for baseball. 1 hour.
182. **Swimming, I.** Introductory skills, knowledge, and conditioning essential for swimming. Open only to nonswimmers and those with no deep water experience. 1 hour. May be repeated once for credit.
183. **Competitive Swimming.** Skills, knowledge, and conditioning essential for strokes, starts, and turns; emphasis on training for competitive participation as well as meet organization. Prerequisite: Physical Education 231 or consent of instructor. 1 hour.
184. **Springboard Diving.** Introductory skills, knowledge, and conditioning essential for springboard diving. Prerequisite: Physical Education 231 or consent of instructor. 1 unit. May be repeated once for credit.
185. **Synchronized Swimming, I.** Introductory skills, knowledge, and conditioning essential for creating aquatic compositions. Prerequisite: Physical Education 231 or consent of instructor. 1 hour.
186. **Aquatic Sports.** Introductory skills, knowledge, and conditioning essential for various aquatic activities, including speed swimming, springboard diving, and water polo. Pre-

- requisite: Physical Education 231 or consent of instructor; the ability to swim one-half mile nonstop, including 20 yards underwater and 100 yards of each of the following: front crawl, back crawl, and breaststroke. 1 hour.
188. **Life Saving.** American Red Cross training for the prevention of aquatic mishaps and for life saving. Prerequisite: Ability to swim one-half mile including 20 yards underwater and 100 yards of each of the following: sidestroke, breaststroke, and front crawl. 2 hours.
190. **Water Safety Instructor Training.** American Red Cross Instructor training for the teaching of swimming and life saving. Prerequisite: Physical Education 231 or consent of instructor; a Red Cross Senior Life Saving authorization card. 2 hours.
193. **Canoeing.** Introductory skills and knowledge essential for handling a canoe with safety. Prerequisite: Physical Education 231 or consent of instructor; the ability to jump or dive into deep water while clothed and maintain a survival position for 10 minutes. 1 hour.
194. **SCUBA Diving.** Introductory skills, knowledge, and conditioning essential for SCUBA diving. A certification card will be issued upon successful completion of the course. Prerequisite: Physical Education 231 or consent of instructor; medical certification. 2 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Apparatus, II.** Intermediate skills, knowledge, and conditioning relative to participation on heavy apparatus. Prerequisite: Physical Education 117 or consent of instructor. 1 hour.
207. **Ballroom Dance, II.** Intermediate skills and understanding essential for ballroom dance; emphasis on fox-trot, rhumba, lindy, waltz, and cha-cha as well as tango, samba, and pasodoble. Prerequisite: Physical Education 134 or consent of instructor. 1 hour.
211. **Modern Dance, II.** Intermediate level technique, improvisation, and composition for both men and women; multimedia approaches to dance and dance criticism. Prerequisite: Physical Education 138 or consent of instructor. 1 hour.
213. **Bowling, II.** Intermediate skills and understanding essential for bowling. Prerequisite: Physical Education 143 or consent of instructor. 1 hour.
214. **Golf, II.** Intermediate skills and understanding essential for use of irons and woods; analysis of course play. Prerequisite: Physical Education 144 or consent of instructor. 1 hour.
215. **Figure Skating, II.** Intermediate skills, knowledge, and conditioning essential for figure skating, with emphasis on skills to pass the United States Figure Skating Association's preliminary tests. Prerequisite: Physical Education 145 or consent of instructor. 1 hour.
216. **Figure Skating, III.** Advanced skills, knowledge, and conditioning essential for figure skating, with emphasis on skills to pass the first eight tests of the United States Figure Skating Association. Prerequisite: Physical Education 215 or consent of instructor. 1 hour.
223. **Tennis, II.** Intermediate skills, knowledge, and attitudes for effective court play. Prerequisite: Physical Education 158 or consent of instructor. 1 hour.
228. **Volleyball, II.** Intermediate skills, knowledge, and conditioning essential for power volleyball. Prerequisite: Physical Education 164 or consent of instructor. 1 hour.
231. **Swimming, II.** Intermediate skills, knowledge, and conditioning essential for swimming. Open only to swimmers who can execute a minimum of one of the five basic strokes in deep water, perform a standing dive, and tread in deep water. Prerequisite: Physical Education 182 or consent of instructor. 1 hour.
233. **Synchronized Swimming, II.** Skills and knowledge at the intermediate level for creating aquatic compositions with an emphasis on choreography. Prerequisite: Physical Education 185 or consent of instructor. 1 hour.
239. **Performance and Analysis of Physical Activities.** Introduction to the development of motor skills in selected physical activities; emphasis on the analysis of performance and

developmental sequence as determined by different age groups, body build, and sex factors. Understanding is gained through activity, field trips, and seminars. 3 hours.

240. **Social Scientific Bases of Sport.** Introduction to the social science aspects of physical education and sport; particular emphasis on concepts derived from the social sciences (including psychology) that are appropriate to physical education and sport. 3 hours.
241. **History of Sport.** Deals principally with the social, cultural, and economic aspects of the sport movement in the Western world; secondary emphasis on methods of historical research. 3 hours.
249. **Sport and Modern Society.** The sociological analysis of sport in modern societies with regard to social class, politics, community, education, and collective behavior. 3 hours.
250. **Bioscientific Foundations of Man Moving.** Introduction to the anatomical, physiological, and biomechanical principles of human movement; particular emphasis on developing concepts of how the body moves, movement awareness, environmental determinants, exercise stress, physical conditioning, kinesiotherapy, and physical fitness. 3 hours.
251. **Theory of Prescribing Exercise.** Prescription and conduct of recreational and exercise programs for selected physical handicaps. Prerequisite: Physiology 103 and 234. 3 hours.
252. **Prevention and Care of Athletic Injuries.** Diagnostic procedures, massage, taping, bandaging, hydrotherapy, electrotherapy, handling emergency conditions, training quarters, facilities, and hygiene. Prerequisite: Physiology 103 and 234. 3 hours.
260. **Physical Education as a Profession.** The nature and scope of physical education as a profession; emphasis on orientation to the profession as well as understanding necessary for selecting an area of specialization within physical education. 2 hours.
262. **Motor Development in Childhood.** Study of the selection of specific movement experiences for the elicitation and maintenance of developmental sequences in children and youths based on physical growth and motor development; observational experiences provided with children in a variety of settings. Prerequisite: Physical Education 250 or Home Economics 105. 3 hours.
263. **Curriculum Development in Elementary School Physical Education.** Curriculum planning, methods, organization, and evaluation of physical education in the elementary school. Prerequisite: Physical Education 262 or consent of instructor. 2 hours.
264. **Organization and Administration of Physical Education.** The scope of this course is concerned with the organization and administration of a total physical education program, including administrative philosophy; the physical education program; physical education staff, facilities, and equipment; the budgetary process; legal liability; discipline; and public relations. 3 hours.
265. **Fitness Programs.** This course includes subject matter related to the "why" and "how" of physical activity; lectures provide an introduction to the physiology of exercise; and practical work includes physical fitness tests, calisthenics, and leadership techniques in a physical education class. 2 hours.
266. **Basic Movement and Body Mechanics.** Experiences, skills, and knowledge relative to structure and function of the human body in selected physical education and dance activities. 1 hour.
269. **Physical Education for the Classroom Teacher.** Curriculum, methods, and organization of physical education in the elementary school. For non-physical education majors. Prerequisite: Junior standing. 2 hours.
270. **Principles of Evaluation and Assessment.** An introduction to the methods and techniques of evaluation and assessment of human performance in physical education and sport. Prerequisite: Physical Education 260; Mathematics 111 or 112, or equivalent score on the Mathematics Placement Test. 3 hours.
271. **Administration of High School Sport Programs.** Organization of sports programs, team sports, intramural programs, and recreational sports programs. 3 hours.
272. **Organization of Aquatic Programs.** Same as Recreation 272. History of aquatics; lead-

- ership training methods; swimming pool sanitation; pool and beach control; and operational records. 2 hours.
273. **Instructional Strategies in Physical Education.** Knowledge of the teaching-learning process and performance outcomes transmitted into instructional strategies; emphasis on the identification of strategies specific to skill development in physical education activities. Prerequisite: Physical Education 282; concurrent registration in an instructional strategies course in a specific activity area. 1 hour.
275. **Instructional Strategies in Social Dance Forms.** Instructional strategies for teaching ballroom, folk, and American square dance. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in ballroom or folk or square dance. 2 hours.
276. **Instructional Strategies in Gymnastics.** Instructional strategies for the teaching of gymnastics. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in apparatus or tumbling. 2 hours.
277. **Instructional Strategies in Small Group Activities.** Instructional strategies for the teaching of small group activities; special emphasis given to skill acquisition, development and recognition of offensive and defensive systems, and discussion of motivational and instructional agents which facilitate performance. Prerequisite: Credit or concurrent registration in Physical Education 273; credit in a small group activity at intermediate level of skill. 2 hours.
278. **Instructional Strategies in Large Group Activities.** Instructional strategies for the teaching of large group activities; special emphasis given to techniques of skill acquisition, development and recognition of offensive and defensive systems, and discussion of motivational and instructional agents which facilitate performance. Prerequisite: Physical Education 273; credit in a large group activity at intermediate level of skill. 2 hours.
279. **Instructional Strategies in Swimming.** Instructional strategies for the teaching of swimming. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in swimming. 2 hours.
282. **Psychology of Learning and Teaching Physical Education.** Physical education knowledge applied to teaching methodology in the learning process; special emphasis on the identification and assimilation of the interdependency of physical education goals, transmission process, and performance outcomes specific to elementary and secondary physical education. Prerequisite: Physical Education 239, 250, and 260; or consent of instructor. 3 hours.
285. **Supervised Experiences in Physical Education Research.** Supervised laboratory experiences in physical education research; individual work under the supervision of members of the faculty in their respective fields. The student assists with data collection, processing, and analysis for research in progress. Prerequisite: Physical Education 260 or consent of instructor. 3 hours. May be repeated for a total of 6 hours.
286. **Supervised Experience in the Common School.** Supervised practice in observing, assisting, and teaching children in preelementary school, elementary school, junior high school, and senior high school; emphasis on understanding motor behavior, teacher-learner behavior, and interrelatedness with other aspects of the learning environment. Prerequisite: Physical Education 282 or equivalent. 3 hours. May be repeated for a maximum of 6 hours.
287. **Supervised Experiences in the Agency Setting.** Supervised practical experience in physical education leadership roles in nonschool agency settings; emphasis on observing, planning, and conducting physical activity programs for children and/or adults in preschool, recreation, or other social agencies. Prerequisite: Physical Education 282 or equivalent. 3 hours. May be repeated for a maximum of 6 hours.
290. **Honors Seminar.** Same as Health Education 260 and Recreation 260. Lectures and discussion dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average

of 4.0 the preceding semester; consent of faculty advisor, instructor, and head of department. 2 hours. May be repeated for a maximum of 6 hours.

291. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the students. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty advisor, instructor, and head of department. 2 or 3 hours. May be repeated for a maximum of 4 to 6 hours.
292. **Advanced Football.** Offensive and defensive strategy; training drills. 1 hour.
293. **Advanced Basketball.** Offensive and defensive strategy; training drills. 1 hour.
294. **Advanced Gymnastics.** Involves the review of basic skills and study of advanced skills, and leads to qualification as an instructor of gymnastics at the elementary, secondary, and college levels; includes methods of teaching, safety devices and practices, and practical learning of progressions for the several gymnastics events. Prerequisite: Consent of instructor. 2 hours.
295. **Advanced Wrestling.** Designed to review the basic skills and to introduce more advanced wrestling techniques and strategies, thereby preparing better qualified wrestling instructors and coaches for the various educational levels. Prerequisite: Consent of instructor. 2 hours.
296. **Theory of Coaching.** Basketball, football, and baseball schedule making; team management; scouting; and officiating. Prerequisite: Consent of instructor. 2 hours.
305. **Principles of Ergonomics.** Same as Industrial Engineering 305 and Physiology 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame, responses to environmental stress (heat, vibration, noise), vigilance and fatigue, and man-machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Industrial Engineering 306 and Physiology 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
341. **International Physical Education and Sport.** A study of objectives, methods, personnel, facilities, and evaluation of selected national programs of physical education; additional consideration given to sports clubs, indigenous games, and research. Prerequisite: Physical Education 241 or consent of instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
343. **Social Psychology and Motor Behavior.** Same as Recreation 343. The use of social psychological theory and methods in the study of motor behavior; emphasis given to the influence of social psychological processes on motor skill acquisition, including such variables as social facilitation, competition, aggression, attitudes, and personality. Prerequisite: Educational Psychology 390; Psychology 201; or consent of instructor. 4 hours or 1 unit.
348. **Social Problems Related to Physical Activity and Sport.** Same as Recreation 348. A seminar with field study on physical activity and sport for marginal, deviant, or sociopsychologically deprived groups. Prerequisite: Six hours in the social sciences or consent of the instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
349. **Analysis of Small Groups in Play or Sport.** Same as Recreation 349. The methodology of small group research and analysis of the small group in play and sport; culture, social structure, and personality structure in the group; and class and student observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
350. **Theory and Practice of Exercise Therapy.** Theory and practice of therapeutic exercise as it applies to physical rehabilitation of the physically handicapped; physiological and

- kinesiological principles of physical restoration; physical educator's role as related to ancillary medical forces; and problems and principles related to kinesiotherapy, preventive, adapted, and remedial physical education, and athletic training. Prerequisite: Physiology 103 and 234; Physical Education 250 and 355; or consent of instructor. 4 hours, or $\frac{1}{2}$ or 1 unit.
352. **Physiology of Physical Activity.** Study of the immediate and long-term physiological effects of exercise upon the body; mechanisms of neuromuscular, cardiorespiratory, and metabolic control and adaptation relative to physical activity. Laboratory and lecture. Prerequisite: Physical Education 250; Physiology 103 and 234; or equivalent. 3 hours or 1 unit.
354. **Growth and Physical Development of Children.** A study of the growth and physical development of children through adolescence with emphasis on those systems and body composition changes related to motor performance and exercise stress. Prerequisite: Physiology 103 and 234; Physical Education 270; or equivalent. 3 hours or 1 unit.
355. **Kinesiology.** The scientific study of the anatomical and biomechanical principles of human performance; utilization of cinematography and electromyography in the analysis of selected physical education activities. Prerequisite: Physical Education 250 or equivalent; Physiology 234 or equivalent; Mathematics 104 or equivalent; or consent of instructor. 3 hours or 1 unit.
357. **Motor Learning.** Discussion and analysis of scientific principles related to the learning and performance of motor skills; review of related literature and research in motor learning. Prerequisite: Psychology 100 or consent of instructor. 4 hours or 1 unit.
363. **Curriculum Development and Trends.** Curriculum planning and development in physical education with emphasis on ecological, biological, psychological, and sociological factors influencing programs in schools and colleges. Prerequisite: Physical Education 264 or consent of instructor. 4 hours or 1 unit.
364. **Problems of Facilities Planning, Construction, and Utilization.** Physical education facilities as related to objectives of physical education; consultant services with planning committees and architects; cost factors in different types of construction; the use of standards as a check on and guide for planning; safety factors; changes in playing surfaces due to research; and building and fields maintenance programs. Prerequisite: Physical Education 264 or equivalent, or consent of instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
394. **Special Topics in Physical Education.** Lecture course on topics of current interest; specific topics announced in the Timetable. Prerequisite: To be determined for each subject and indicated in the Timetable. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated.
440. **History of Physical Education and Sport.** An analysis of the research literature related to the historical foundations of physical education and sport; discussion of such persistent historical problems as the influence of economics, politics, and nationalism; curriculum and methods of instruction; professional preparation; the healthy body; dance; the use of leisure; and amateur and professional sport. Prerequisite: Physical Education 241 or equivalent. 1 unit.
441. **Philosophy of Physical Education and Sport.** Philosophical analysis of physical education and sport (with some reference to school health and recreation) in the light of the leading philosophical tendencies and possible implications for public and private education; analysis of completed research; and delineation of one's personal philosophy and the use of philosophical analysis as a research technique. Prerequisite: Philosophy 101; History and Philosophy of Education 305. 1 unit.
443. **Group Dynamics in Sport.** Same as Recreation 443. Theories and methods in the study of the psychology of small group behavior in sport; analysis of the literature pertaining to group structure and group processes, with particular emphasis on group performance in sport. Prerequisite: Physical Education 343 or consent of instructor. 1 unit.
447. **Sport Psychology.** Analysis of psychological factors and principles with special reference to motor performance, learning motor skills, perception, and emotion in sports situations; review of literature; and independent projects. Prerequisite: Psychology 100; Educational Psychology 211; consent of instructor. 1 unit.

449. **The Sociology of Sport.** Same as Sociology 449. Sociological analysis of sport with emphasis on sociological theory; sport and games in cross-cultural analysis; sport's structure and function in modern industrialized society; the system of sport in regard to its role structure, formal organization, and professionalization; its differentiation along social class, age, and sex; and sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
451. **Scientific Bases of Physical Performance.** Contemporary trends in the study of human performance and exercise stress; analysis of the research literature, experimental strategies, and research instrumentation. Lecture-discussion and laboratory. Prerequisite: Physical Education 352 or 354; Physical Education 355; or equivalent. 1 unit.
452. **Neuromuscular Aspects of Human Performance.** In-depth study of the neuromuscular aspects of human activity; focus on selected topics related to growth, physical development, exercise prescriptions, athletic conditioning, and fitness. Lecture-discussion and laboratory. Prerequisite: Physical Education 451. 1 unit.
453. **Circulorespiratory Aspects of Physical Activity.** Aerobic performance responses to short-term, intermittent, and prolonged physical activity; special consideration given to endurance training methods and assessment techniques, ergogenic aids, and problems associated with growth, environmental influences, and competitive sport. Lecture-discussion and laboratory. Prerequisite: Physical Education 451 or consent of instructor. 1 unit.
455. **Experimental Kinesiology.** Mechanical and neuromuscular approach to human movement; analysis, experimental research findings, and lecture and laboratory discussions. Prerequisite: Physiology 234 or equivalent; Physical Education 355 or equivalent; or consent of instructor. 1 unit.
457. **Sensorimotor Development.** Same as Home Economics 457. Study of the development of spatially adapted movement behavior in man; emphasis on the nature of sensorimotor systems and development of perception; the role of proprioceptive feedback mechanisms and associated reflexes; and the neurogeometric principles basic to the study of man interpreting and acting on his environment. Prerequisite: Physical Education 357 or equivalent. 1 unit.
459. **Principles of Kinesiotherapy.** Analysis of medically approved techniques employed in the treatment of disease and injury by exercise and movement; kinesiological evaluation of principles involved; therapy preparation in teaching techniques; medically prescribed clinical training; and literature and research. Prerequisite: Physiology 234; Physical Education 250 and 355; or consent of instructor. 1 unit.
461. **Administration of Physical Education and Sport.** Analysis of completed research relating to theory and practice of administration in physical education and sport; the development of policy statements and procedures manuals for the various educational levels; and experience in the use of the case plan of instruction as a teaching technique for the development of competence and knowledge relating to human relations and administration in this specialized field. Prerequisite: Physical Education 264 or equivalent. 1 unit.
473. **Ergonomics Seminar.** Same as Industrial Engineering 473 and Physiology 473. In-depth exploration of topics in ergonomics, such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Physical Education 306. ½ unit.
490. **Seminar.** Lectures, discussions, and critiques on physical education and related subjects by faculty members and visiting professional leaders; presentation and criticism of student theses. 0 credit.
493. **Independent Study.** Independent research on special projects; offered summers as a special group practicum. ½ or 1 unit.
494. **Special Topics in Physical Education.** Lecture course in topics of current interest; specific subject matter announced in the Timetable. ½ or 1 unit. May be repeated.

495. **Techniques of Research in Health, Physical Education, and Recreation.** Review and appraisal of common research procedures; application of statistical procedures, library methods, evaluation procedures, and experimental methods. 1 unit.
499. **Thesis Research.** Preparation of theses in physical education. 0 to 4 units.

PHYSICS

Head of Department: Professor R. O. Simmons

Department Office: 211 Physics Building, Urbana

101. **General Physics (Mechanics, Heat, and Sound).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Trigonometry. 5 hours.
102. **General Physics (Light, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Physics 101. 5 hours.
106. **General Physics (Mechanics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Mathematics 120; credit or concurrent registration in Mathematics 130 or 131. 4 hours.
107. **General Physics (Heat, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 106; credit or concurrent registration in Mathematics 140 or 141. 4 hours.
108. **General Physics (Wave Motion, Sound, Light, and Modern Physics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 107; credit or concurrent registration in Mathematics 140 or 141. 4 hours.
140. **Practical Physics: How Things Work--A Course for Nonscientists.** A nonmathematical lecture-demonstration course for nonscience students, underscoring the generality and ubiquity of basic physical laws in understanding commonplace phenomena: musical instruments, photography, electric and electronic circuits, television, motors, engines, etc. 3 hours. No credit for students in the College of Engineering.
141. **Special Problems.** Special problems in physics: discussions and independent study. Supplement to Physics 140. Prerequisite: Credit or concurrent registration in Physics 140. 1 hour.
150. **Physics and the Modern World: A Course for Nonscientists.** A nonmathematical lecture course attempting to bridge the two-culture gap; takes examples from modern physics: relativity, elementary particles, quantum theory, statistics, etc., and covers basic philosophical concepts in physics which pervade all human disciplines: model-making, dynamics, ensemble behavior, and symmetry. 3 hours.
151. **Special Problems.** Special problems in physics: discussions and independent study. Supplement to Physics 150. Prerequisite: Credit or concurrent registration in Physics 150. 1 hour.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
302. **Principles of Atmospheric Dynamics.** Same as Atmospheric Sciences 302. An introduction to those elements of fluid dynamics and thermodynamics which are essential to understanding the large- and small-scale motions of the neutral atmosphere. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
303. **Modern Experimental Physics, I.** Techniques and experiments in the physics of atoms, atomic nuclei, molecules, the solid state, and other areas of modern physical research. Prerequisite: Physics 342; credit or concurrent registration in Physics 381 or 386. 3 to 5

hours, or $\frac{1}{2}$ to 1 unit. Students taking the course for the first time must register for 5 hours or 1 unit. Those repeating the course may do so for variable credit of 3 to 5 hours, or $\frac{1}{2}$ to 1 unit.

321. **Theoretical Mechanics.** Motion of a particle in one, two, and three dimensions, with applications; Kepler's laws and planetary motion; scattering of particles; conservation laws; motion of a rigid body in two dimensions; statics of extended systems; and lectures and problems. Prerequisite: General physics; credit or concurrent registration in Mathematics 341, 345, or 349. 4 hours or 1 unit. No graduate credit for graduate physics majors.
322. **Theoretical Mechanics.** Continuation of Physics 321. Moving coordinate frames and fictitious forces; special theory of relativity, conservation laws, and particle motion and creation; rigid body motion in three dimensions; gravitation and earth motion; generalized coordinates and Lagrange's equations; and constraints and small vibrations. Prerequisite: Physics 321. 4 hours or 1 unit.
341. **Intermediate Electricity and Magnetism, I.** Basic laws of electricity and magnetism; emphasis on vector methods; electric fields, potential, capacitance, and dielectrics; conductors, magnetic fields, and magnetic induction; inductance, transients in RL, RC, and RLC circuits; and linear response theory. Lectures, problems, and laboratory. Prerequisite: Two semesters of general physics; concurrent registration in Mathematics 341, 343, or 345; or consent of instructor. 5 hours, or $\frac{3}{4}$ or 1 unit ($\frac{3}{4}$ unit without laboratory). No graduate credit to graduate physics majors.
342. **Intermediate Electricity and Magnetism, II.** Continuation of Physics 341; applications of the basic laws; magnetostatics, boundary conditions, Ampere's law for magnetic media, magnetostatic energy and force, magnetic materials, AC circuits, filters, transmission lines; and wave propagation in dielectrics and conductors, waveguides, cavities, and radiation from antennas. Lectures, problems, and laboratory. Prerequisite: Physics 341. 5 hours, or $\frac{3}{4}$ or 1 unit ($\frac{3}{4}$ unit without laboratory). No graduate credit to graduate physics majors.
343. **Electronic Circuits, I.** The physics of semiconductor devices; theory and application of discrete and integrated devices in linear circuits; use of operational amplifiers and feedback; regulation, oscillators, and modulation; and emphasis on practical experience. Lectures, problems, and laboratory. Prerequisite: Physics 341 or consent of instructor. 5 hours or 1 unit.
344. **Electronic Circuits, II.** Continuation of Physics 343 with particular emphasis on non-linear devices, switching circuits, digital logic, analog to digital and digital to analog conversion, and individual projects. Lectures, problems, and laboratory. Prerequisite: Physics 343 or consent of instructor. 5 hours or 1 unit.
347. **Electromagnetic Theory and Boundary Value Problems.** Beginning with Maxwell's equations, this course treats electrostatic and magnetostatic boundary value problems and multipole expansions with orthogonal polynomials; boundary value problems in quasistatic and radiation fields; simple radiating systems; and scattering of scalar waves. Prerequisite: Mathematics 343 and 345; Physics 342 or Electrical Engineering 229, or consent of instructor. 4 hours or 1 unit.
360. **Thermodynamics.** Zeroth, first, second, and third laws of thermodynamics; applications to simple physical and chemical systems; thermodynamic inequalities and equilibrium; and phase transitions. Lectures and problems. Prerequisite: General physics and calculus; senior standing in physics advised. 4 hours or 1 unit.
362. **Kinetic Theory and Statistics.** A lecture and problem course presenting the fundamentals of kinetic theory and an elementary introduction to statistical mechanics; topics covered include equations of state, the distribution law, viscosity, thermal conduction, diffusion, and Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics and applications. Prerequisite: Physics 360 or consent of instructor. 3 hours or 1 unit.
365. **Introduction to Plasma Physics.** Physical concepts underlying the description of ionized gases; individual particle and continuum models; collision processes in plasmas; charged particle motion in electromagnetic fields; waves in cold plasmas; elementary

treatment of collective plasma behavior; simple plasma instabilities; and selected topics of current interest. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 4 hours or 1 unit.

366. **Aeronomy: Physics of the Upper Atmosphere and Space.** Same as Astronomy 366 and Electrical Engineering 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmosphere; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; and experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.
371. **Light.** Wave kinematics; geometrical optics: basic concepts, ray-tracing and matrix formalism, Gaussian imaging by thick lenses, stops, and apertures, and intensity relations; interference; interference spectroscopy and coherence; diffraction: Fresnel-Kirchhoff formulation, Fraunhofer case, Fresnel case, and holography; and polarized light. Lectures, laboratory, and problems. Prerequisite: Physics 101 and 102, or Physics 106, 107, and 108; Mathematics 345; or consent of instructor. 4 hours, or $\frac{1}{2}$ or 1 unit.
381. **Atomic Physics.** Same as Chemistry 396. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules; discussion of topics including evidence for the atomic nature of matter; the properties of free electrons and ions; photons and their interaction with matter; atomic spectra and structure; molecular spectra and structure; and an introduction to the ideas of quantum mechanics. Students may not receive credit for both Physics 381 and 386. Prerequisite: General physics; Mathematics 343 or 345. 4 hours or 1 unit.
382. **Subatomic Physics.** A lecture and problem course surveying subatomic physics; includes the nature and properties of nuclei and elementary particles, symmetries, interactions, nuclear models, tools and techniques of experimental subatomic physics, and applications to power generation, astrophysics, chemistry, medicine, and biology. Prerequisite: Physics 383, 385, or 386, or consent of instructor. 4 hours or 1 unit.
383. **Atomic Physics and Quantum Theory.** Introduction to the basic concepts of quantum theory which underlie modern theories of the properties of materials; topics covered include elements of atomic and nuclear theory; kinetic theory and statistical mechanics; quantum theory and simple applications; atomic spectra and atomic structure; molecular structure and chemical binding. Lectures and problems. Prerequisite: General physics; general chemistry; Mathematics 345 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
385. **Introduction to Quantum Mechanics.** A one-semester treatment of quantum mechanics covering the fundamental postulates of quantum theory; the Schrodinger wave equation as applied to simple bound state and scattering problems; the nonrelativistic hydrogen atom; angular momentum; steady-state and time-dependent perturbation theory; and systems of identical particles. Recommended for science students who wish to acquire familiarity with quantum mechanics. Students may not receive credit for both Physics 385 and either of Physics 386 or 387. Prerequisite: Mathematics 343 and 345; general physics through intermediate mechanics and electromagnetic theory. 4 hours or 1 unit.
386. **Atomic Physics and Quantum Mechanics, I.** Study of atomic phenomena integrated with an introduction to quantum theory; discussion of topics including evidence for the atomic nature of matter and the properties of the Schrodinger equation, single particle solutions in one dimension, the hydrogen atom, perturbation theory, external fields, and atomic spectroscopy of outer electrons. Students may not receive credit for both Physics 381 and 386, and for both Physics 385 and 386. Prerequisite: General physics; Mathematics 343 or 345, or consent of instructor. 4 hours or 1 unit.
387. **Atomic Physics and Quantum Mechanics, II.** Continuation of Physics 386. Topics treated include identical particles; spectral hyperfine structure; magnetic properties of matter; atomic spectroscopy of inner electrons; high-energy photon effects; molecular binding and spectra; emission and absorption of light; and symmetry principles. Stu-

dents may not receive credit for both Physics 387 and 385. Prerequisite: Physics 386. 4 hours or 1 unit.

389. **Introduction to Solid State Physics.** Bonding and structure of crystals; energy bands in insulators, semiconductors, and metals; electrical conductivity; optical properties; lattice vibrations; elasticity; point defects; and dislocations. Prerequisite: Junior standing in science or engineering, or equivalent. 4 hours or 1 unit.
397. **Individual Study.** Individual study at an advanced level in a subject not covered by course offerings. Prerequisite: Upperclassman; consent of adviser and staff member who supervises the work. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated once.
398. **Seminar on Special Topics in Modern Physics.** Lecture course on topics of current interest in physics. For advanced undergraduates or graduates. Subjects and prerequisites to be announced in the Timetable. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
402. **Theoretical Astrophysics.** Same as Astronomy 402. Application of physical principles to selected topics in astrophysics, including stellar structure and evolution, neutron stars and pulsars, cosmic electrodynamics, and cosmological problems; emphasis on the physics involved rather than on detailed factual description. Prerequisite: Physics 342 or 386, or consent of instructor. 1 unit.
404. **Stellar Structure and Evolution.** Same as Astronomy 404. Relationship between observable features of stars and the physical processes that occur in their interiors; topics include matter and radiation in stars: equations of state, modes of energy flow, nuclear energy production, and element synthesis; structure of stars during all phases prior to the supernova or planetary nebula stage; stellar pulsations with reference to Cepheids and RR Lyrae variables; and properties of white dwarfs, neutron stars, and contact binaries. Prerequisite: Physics 360 and 382; or Physics 402; or consent of instructor. 1 unit.
411. **Special Functions and Boundary Value Problems in Physics.** Use of special functions in solving homogeneous partial differential equations of physics; emphasis on applications to topics such as electrostatics, wave guides and resonant cavities, vibrations of membranes, heat flow, and potential flow in fluids. Prerequisite: Mathematics 343 and 345, or equivalent. This course may be taken concurrently with Physics 413 or 414. $\frac{1}{2}$ unit.
412. **Additional Techniques of Mathematical Physics.** Solution of inhomogeneous differential equations with particular emphasis on problems in electromagnetism; additional topics such as perturbation theory, variational methods, and integral equations; and emphasis on application of the techniques to nonquantum physics problems. Prerequisite: Physics 411 or equivalent. This course may be taken concurrently with Physics 413 or Physics 414. $\frac{1}{2}$ unit.
413. **Uses of Complex Variables in Physics.** A review of complex variable theory, with emphasis on calculations useful to physicists; integration, conformal mapping, Laplace and Fourier transforms, and additional topics of use in theoretical physics. Prerequisite: Undergraduate mathematics at the level of Mathematics 343 and 345; some previous exposure to complex variables helpful, but not required. $\frac{1}{2}$ unit.
414. **Basics of Advanced Mechanics.** Fundamentals of classical Lagrangian and Hamiltonian mechanics, with emphasis on the relation between dynamical symmetries and constants of the motion; use of conservation laws to derive basic equations of fluid dynamics; and discussion of some applications. Prerequisite: Mechanics at the level of Physics 322 or consent of instructor. $\frac{1}{2}$ unit.
424. **Relativity and Cosmology.** Same as Astronomy 424 and Mathematics 460. Elements of tensor calculus and Riemannian geometry; special relativity: Lorentz transformations; equivalence of mass and energy; general relativity and the gravitational field of the sun; and galaxies and cosmology. Prerequisite: Consent of instructor. 1 unit.
430. **Surface Physics.** Same as Metallurgical Engineering 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction and structure; gas-solid collisions; Brownian motion, and diffusion and evaporation; electron and ion emission, and tunnelling; Van der Waals forces; the-

- ory of chemical interactions; and kinetics and statistics of absorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
435. **Theory of Semiconductors and Semiconductor Devices.** Same as Electrical Engineering 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; and characteristics of p-n junctions, heterojunctions, and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
442. **Classical Electromagnetic Radiation.** A review of Maxwell's equations followed by a relativistic formulation of the electromagnetic field and the motion of charged particles; plane and guided waves; retarded potentials; radiation from simple antennas; radiation from accelerated charged particles; and synchrotron radiation, bremsstrahlung, scattering, and further topics. Prerequisite: Physics 411 and 412, or equivalent; electromagnetism at the level of Physics 341 and 342; special relativity at the level of Physics 322. 1 unit.
455. **Reactor Physics, I.** Same as Nuclear Engineering 455. Introduction to the physical concepts of reactor analysis; nuclear cross sections, diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; and computer applications in reactor analysis. Prerequisite: Nuclear Engineering 347, Mathematics 343 and 345, or consent of instructor. 1 unit.
456. **Reactor Physics, II.** Same as Nuclear Engineering 456. Continuation of Physics 455. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; and digital computer methods. Prerequisite: Physics 455 or consent of instructor. 1 unit.
462. **Statistical Mechanics and Kinetic Theory.** Single-particle distribution functions: classical and quantum mechanical systems, Boltzmann equation, virial theorem, and equations of state for gases; formal theory: ensembles, identical particles, thermodynamics of simple systems, and distribution functions; nonequilibrium problems; conservation laws and hydrodynamics equations, sound waves, and transport coefficients; and plasmas, normal Fermi fluid, superfluids, and systems with internal degrees of freedom. Prerequisite: Physics 360 and elementary quantum mechanics, or consent of instructor. 1 unit.
463. **Low Temperature Theory and Quantum Liquids.** Normal Fermi liquids: equilibrium properties, transport equation, quasi-particle collisions, degenerate He, and Landau theory; formal description of experimental measurements in neutral and charged Fermi liquids; superfluid Bose liquid: He II, rotating buckets, macroscopic description of superfluid flow, two-fluid model, first, second, and quasi-particle sound, vortex lines, and microscopic theory; and superconductivity: BCS theory, electrodynamics and coherence effects, superconductivity in metals, tunnel effect, flux quantization, microscopic theory of superfluid flow, and vortices. Prerequisite: Physics 362 or 462 and 481, or consent of instructor. 1 unit.
465. **Plasma Physics.** Basic equations of magnetohydrodynamics; orbit theory; stability of plasma configurations; hydromagnetic waves; plasma oscillations; high-frequency instabilities; spontaneous fluctuation theory; Fokker-Planck equation; transport processes; oscillations in a magnetic field; and interaction of electromagnetic waves with plasmas. Prerequisite: Physics 362 and 441, or Electrical Engineering 423, or consent of instructor. 1 unit.
470. **Introduction to Nuclear and Particle Physics.** Basic facts of photons, leptons, hadrons, conservation laws, types of interaction, particle production and stability symmetries, and nuclear forces and ground state properties; two-particle systems: electromagnetic interactions, bound states, and resonances; nucleon-nucleon and meson-nucleon interactions; nuclei: properties of low-lying states, models, resonant reactions, and direct processes; and particles and weak interactions: multipion resonances, symmetry

schemes, beta decay and other leptonic processes, and strange particle decays. Prerequisite: Physics 480 or consent of instructor. 1 unit.

471. **Nuclear Physics, I.** Systematics of stable nuclei and the nuclear potential; properties of odd-A nuclei; spherical single-particle shell model; residual interactions; collective states and deformed nuclei; summary of theory and experiment for low-lying states; momentum distribution of nucleons; and fission. Prerequisite: Physics 470. 1 unit.
475. **Particle Physics, I.** Particles: properties and systematics; S-matrix theory; application of symmetry and invariance principles to decays, production processes, and polarization; collision processes; mesonic and baryonic resonances; symmetry schemes; particle scattering at very high energies; and theory of pion-nucleon scattering, dispersion relations, and Mandelstam representation. Prerequisite: Physics 470; credit or concurrent registration in Physics 483 recommended. 1 unit.
476. **Particle Physics, II.** Electromagnetic interactions of particles, form factor, and predictions of unitary symmetry; beta and muon decay and capture, conserved and partially conserved currents, neutrino interactions, and weak interaction form factors; leptonic and nonleptonic decays of strange particles; neutral K-meson decays; and current topics. Prerequisite: Physics 470; credit or concurrent registration in Physics 483 recommended. 1 unit.
477. **Seminar in High-Energy Physics.** Under the guidance of faculty, students study and report on topics of current interest in high-energy physics. Prerequisite: Physics 470 or consent of instructor. $\frac{1}{2}$ unit. May be repeated for credit.
480. **Quantum Mechanics, I.** A second course in quantum mechanics for students with a good background in wave mechanics and atomic and molecular structure. Operators, state vectors, and the formal structure of quantum theory, and operator treatments of simple systems; angular momentum and vector addition coefficients; stationary state perturbation theory; introduction to scattering theory for particles without spin, partial wave analysis, and Born approximation; and examples taken from atomic, nuclear, and elementary particle physics. Prerequisite: Senior-level atomic physics and quantum mechanics, or consent of instructor. 1 unit.
481. **Quantum Mechanics, II.** Spin and identical particles, simple many-particle systems and elements of second-quantization theory; time-dependent processes, radiative transitions, and quantization of the electromagnetic field; scattering of particles with spin; polarization; and introduction to the Klein-Gordon and Dirac equations, and properties of simple relativistic systems. Prerequisite: Physics 480 or consent of instructor. 1 unit.
483. **General Field Theory.** Covers standard techniques of field theory as used by experimenters and theorists; relativistic quantum mechanics of a single particle; Lagrangian field theories, perturbation theory, and calculation of lowest-order processes; introduction to Feynman diagrams and higher order processes; and examples taken from quantum electrodynamics, solid-state and elementary particle physics, and many-body theory. Prerequisite: Physics 481 or consent of instructor. 1 unit.
485. **Advanced Field Theory.** Renormalization theory, dispersion relations, and S-matrix theory; current algebra; and recent developments. Prerequisite: Physics 483 or consent of instructor. 1 unit.
489. **Solid State Physics, I.** Crystalline perfection, free electron gas, screening, plasma oscillations, and dielectric response; Bloch electrons, Brillouin zones, and band structure; semiconductors, intrinsic and extrinsic, with applications; phonons, elasticity, and anharmonicity; ferromagnetism and second-order phase transitions; and superconductivity. Prerequisite: Physics 362 and 480. 1 unit.
490. **Solid State Physics, II.** Hartree-Fock theory and electron-electron interactions; electron-phonon interactions; electron dynamics and transport; BCS theory of superconductivity; elastic properties; thermal properties due to anharmonicity; and defects in solids. Prerequisite: Physics 489. 1 unit.
496. **Seminar on Current Research.** Discussions and lectures on current research, including presentations by graduate students of their own work. 0 units.

497. **Individual Study.** Individual study in a subject not covered in course offerings may be arranged for credit by registration under this number. $\frac{1}{2}$ or 1 unit.
498. **Seminar on Special Topics in Modern Physics.** Lecture course in topics of current interest. Several subjects are announced in each Timetable. Among them are semiconductor physics, magnetic resonance, surface physics, lattice dynamics, band theory of solids, crystal imperfections, nuclear structure, field theory, elementary particle physics, advanced statistical mechanics, plasma theory, astrophysics, atmospheric physics, group theory, and applications. Prerequisite: Determined for each offering. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

PHYSIOLOGY AND BIOPHYSICS

(See Life Sciences)

PLANT PATHOLOGY

Head of Department: Professor R. E. Ford

Department Office: 218 Mumford Hall, Urbana

204. **Introductory Plant Pathology.** Basic concepts relating to causal agents of representative diseases, symptoms and diagnosis, mode of infection and spread, environment and disease development, and methods of control. Prerequisite: Botany 100 or equivalent. 3 hours.
300. **Special Problems.** For students desiring to study specific problems not assigned in other courses. Prerequisite: For undergraduates only, a minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean in advance of registration is required for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
302. **Research Methods in Plant Pathology.** Techniques for the isolation, identification, culture of, and inoculation with plant pathogens; methods for the histological study of diseased plants; and recording of data. Prerequisite: Plant Pathology 204 or equivalent; senior standing. 3 hours or $\frac{3}{4}$ unit.
303. **Plant Nematology.** Experimental techniques, nematode anatomy, taxonomy, biology, and host-parasite relations; intensive study of selected groups including foliar, stem, root-knot, and cyst nematodes; interaction with bacteria, fungi, and viruses in plant disease development; and control principles. Prerequisite: Plant Pathology 204 or equivalent; an introductory course in zoology or biology. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
304. **Forest Tree Diseases and Wood Deterioration.** Symptoms, causal agents, and control of the major forest tree diseases; causes and control of wood deterioration. Prerequisite: Junior standing in forestry or other plant science. 3 hours or $\frac{3}{4}$ unit.
305. **Principles of Plant Disease Control.** Study of the basic concepts of both nonchemical and chemical methods used for the control of plant diseases; lectures, discussions, and assigned reading. Prerequisite: Plant Pathology 204; Chemistry 102, 132, or 133; or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
306. **Epiphytology and Diagnosis of Plant Diseases.** Detailed consideration of factors influencing the incidence and severity of diseases caused by fungi, bacteria, viruses, and

nematodes; ecological factors as etiological agents, and techniques for determining the intensity of epiphytotic; and plant disease identification. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.

307. **International Food Crops.** Same as Horticulture 307. Various international food crops studied with emphasis on production and problems created by diseases and insects; tropical and subtropical crops stressed, but temperate food crops of international importance included; and ecological factors affecting fundamentals of food crop production and plant protection emphasized. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in 1974-75 and in alternate years.
377. **Diseases of Field Crops.** Same as Agronomy 377. Study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
401. **Diseases of Forest and Shade Trees.** A survey of the history, symptomatology, causes, and control of diseases of trees, with assigned reading and performance of illustrative experiments in the laboratory, greenhouse, and field. Prerequisite: Plant Pathology 204 or consent of instructor. $\frac{1}{2}$ or 1 unit. Offered in 1974-75 and in alternate years.
402. **Phytopathology.** Study of pathogenic bacteria and their role in plant disease; history, morphology, reproduction, taxonomy, and identification; emphasis on arrival, invasion, symptoms, and control; and assigned reading, lectures, and laboratory. Prerequisite: Plant Pathology 204 and Microbiology 309, or consent of instructor. $\frac{3}{4}$ unit. Offered in 1975-76 and in alternate years.
403. **Physiology of Fungi.** Same as Botany 403. The germination, growth, metabolism, and sporulation of fungi; physiology of the fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products; and discussion of the nature of fungicidal activity. Prerequisite: Plant Pathology 204 or equivalent; organic chemistry or biochemistry; mycology and microbiology. 1 unit. Offered in 1975-76 and in alternate years.
404. **Plant Virology.** Fundamental concepts; classification, symptomatology, and infectivity; biological, chemical, and physical properties; techniques for transmission, straining, assay, filtration, and purification; control methods; sources of information; and history of virology. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. Offered in 1974-75 and in alternate years.
406. **Genetics of Plant-Pathogen Interactions.** The genetics and expression of resistance in plants to fungi, bacteria, viruses, nematodes, and other pathogens; variation and genetic systems in pathogens with particular emphasis on pathogenicity; complementary genetic systems; and theory and practice of breeding disease-resistant plants. Lectures, discussions, assigned reading, and term paper. Prerequisite: Plant Pathology 204 and Botany 210, or Agronomy 323 or Horticulture 323, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
407. **Physiology of Plant-Parasite Interactions.** Current concepts on physiological and biochemical bases of plant diseases; mechanisms of infection and disease development; theories of resistance and susceptibility; and interrelationships of physiological and biochemical activities that occur during the interaction of plants and their parasites. Prerequisite: One course each in plant pathology, biochemistry, and plant physiology, or consent of instructor. $\frac{1}{2}$ unit.
417. **Discussions in Plant Pathology.** Discussion of current research, literature, and other topics pertaining to plant pathology and related fields. $\frac{1}{4}$ unit.
499. **Thesis Research.** Individual study and research required of all students working toward the Master of Science or Doctor of Philosophy in plant pathology. Prerequisite: Plant Pathology 302 or equivalent. Work can be taken in the following areas, subject to approval of the staff member concerned: (a) biochemistry of plant disease; (b) diseases of corn, genetics of resistance; (c) diseases of cereal grains; (d) diseases of forest and shade trees; (e) diseases of fruit crops, fungicides; (f) diseases of leguminous crops, root diseases; (g) diseases of turf and lawn grasses; (h) diseases of soybeans; (i) diseases of

vegetable and canning crops; (j) nematode diseases; (k) physiology of fungi, antibiotics; and (l) plant virology. 0 to 4 units.

POLISH

(See Slavic Languages and Literatures)

POLITICAL SCIENCE

Head of Department: Professor E. A. Kolodziej

Department Office: 361 Lincoln Hall, Urbana

110. **Government in Illinois.** Nature and work of government; governmental units and their interrelations; the Illinois Constitution and problems of revision; popular control of government; and organs of state government and local finance. Students are not given credit for both Political Science 110 and 312. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 2 hours.
150. **American Government: Organization and Powers.** Historical development and organization of national, state, and local governments; the federal system; national and state constitutions; civil and political rights; party system; and nature, structure, powers, and procedure of legislative, executive, and judicial departments in state and nation. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of department. 3 hours.
151. **American Government: Functions.** Functions of national, state, and local governments; foreign relations and national defense; taxation and finance; law enforcement; police power; regulation of commerce, communications, and business; promotion of social and economic welfare; and current problems. Prerequisite: Political Science 150 or consent of department. 3 hours.
184. **International Relations.** An examination of the nature of the national state system, of the forces affecting international relations, of the sources of conflicts in international politics, and of their solution by power politics or by international cooperation. 4 hours.
189. **Introduction to Political Research.** Designed to familiarize students with statistical concepts, research design, and techniques of research as applied to research problems of current interest in political science. 3 hours.
191. **Principles of Political Science.** The scope and methods of study of political science; basic concepts of political sciences; forces and interests in politics; nature of the state and of the government; and the legislative, executive, administrative, and judicial processes. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 4 hours.
198. **Freshman Seminar.** Current topics in political science in the context of the scope and method of political science. Participants are required to do independent library research and present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
222. **Introduction to Modern Africa.** Same as African Studies Anthropology, and Sociology 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.

241. **The Emerging Nations.** An introductory comparative consideration of the patterns of political development and of the policies and problems of the emerging nations of Asia, Africa, and Latin America; emphasis on the special characteristics of countries beginning their independent nationhood and the effects of these characteristics on the political systems of these lands and their role in the community of nations. Prerequisite: Three hours of political science or consent of instructor. 3 hours.
245. **Black Political Thought and Movements:** U.S.A., Africa, and Caribbean. Political thinkers and movements discussed include W. E. B. DuBois, Panthers, Garveyism, Black Muslims, Nyerere, Harlem Renaissance, Nkrumah Negritude, and Caribbean Nationalism; use of relevant literature to gain knowledge of black political thought and movements, and use of model construct for the purpose of analysis. Prerequisite: Political Science 150 or consent of instructor. 3 hours.
263. **The Executive Branch of Governments of the United States.** A review of the constitutional, political, and administrative responsibilities of the chief executive and executive agencies in national, state, and local governments in the United States. Prerequisite: Political Science 150 or 191. 3 hours.
289. **Seminar in Selected Topics in Political Science.** Selected reading and research in political science. Prerequisite: Junior or senior standing; 6 hours of political science; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 290.
290. **Honors Seminar.** Research, reading, and discussion in selected topics and works in literature of political science. Prerequisite: Junior or senior standing; 6 hours of political science; 4.0 average or James Scholar designation; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 289.
291. **Thesis and Honors Course.** Prerequisite: Written consent of instructor; open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours.
292. **Thesis and Honors Course.** Prerequisite: Written consent of instructor; open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours.
293. **Selected Topics in Political Science.** Readings and reports in selected fields chosen in consultation with the instructor. Prerequisite: Written consent of instructor. 1 to 4 hours. May be repeated.
294. **Contemporary Issues and Problems.** Study of a contemporary problem in public policy, domestic or international, to be announced each term the course is offered. Prerequisite: Sophomore standing or 3 hours of political science, or consent of instructor. 3 hours. May be repeated for credit.
305. **Municipal Government.** Growth of cities; their legal status; and municipal politics and organization in the United States. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **Municipal Problems.** Municipal administration in the United States; administrative organization; personnel problems; financial problems; city planning and housing; police and fire administration; public health; and public utilities. Prerequisite: Senior standing, or junior standing with Political Science 305 or Economics 102 and 103, or 6 hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Rural Local Government.** Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; and problems of reorganization. 3 hours, or $\frac{1}{2}$ or 1 unit.
312. **State Government.** The states in the federal system; state constitutions and problems of revision; organization, powers, and functions of the legislative, administrative, and judicial branches of state government; state functions; reorganization problems in the states; state-local relations; and state finance, trends, and prospects. Students are not given credit for both Political Science 312 and 110. Prerequisite: Political Science 150 or 191. 3 hours, or $\frac{1}{2}$ or 1 unit.

313. **Comparative State Politics.** Approaches state government from an empirical and behavioral orientation, using contemporary sources chosen to introduce current analytical techniques and methods for explicating state politics; analysis of interactions among branches of government along with the impact of policy, interest groups, and constituencies. Prerequisite: Political Science 312, 315, or 328, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
315. **Legislatures and Legislation.** The legislative function in government; structure and organization of American legislatures (national, state, and local); party organization in legislatures; legislative procedure; pressure groups and lobbying; relation of legislature to other branches of government; and problems of legislative reorganization. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **The American Federal System.** The nature, justification, and problems of federalism; coordination of governmental efforts by contract, subsidies, and grants; and comparison of federal systems. Prerequisite: Political Science 150 or 191. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Tax Politics and Administration.** Interactions among the administrative, legal, and legislative aspects of the fiscal decision-making process at federal, state, and local levels; emphasis on current issues. Prerequisite: Political Science 150 or 191. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Government and the Economic Order.** A survey of public policies of national and state governments regulating economic activity; transportation, electrical utilities, communications, antimonopoly, agriculture, and level of economic activity. Prerequisite: Any two courses in political science or a combination of political science and economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Approaches to Political Populations.** Studying political populations through participant observation, nonreactive measures, content analysis, field research, interviewing, questionnaire design, (and other techniques); research ethics surrounding the use of tape recorders, cameras, etc. Prerequisite: Twelve hours of social science; consent of instructor. 3 hours or 1 unit.
326. **American Political Parties.** Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention systems; the primary; and campaign methods and finance. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
327. **Black Political Participation in the American Political Process.** Exposes students to the variety of literature on black people in American politics; political participation is the major theme. Since black and white scholars address themselves to the study of political behavior of blacks, it is necessary to compare not only their views but also to discuss the underlined message, or meaning, of their work to understanding American politics in general. Prerequisite: Political Science 150, or 6 hours or social science, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
328. **An Introduction to the Study of Political Behavior.** An analysis of the interrelations of political attitudes and public formation; special attention to the substantive areas of voting behavior, political leadership, and the rise of political mass movements; and also a review of the literature on democratic and authoritarian personality types. Prerequisite: Political Science 150 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **Electoral Behavior.** Study of the social and psychological motivations behind the individual voting decision, with special emphasis on the relationships between the voting decision and social stability. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
331. **British Government.** Nature of the British Constitution; the Crown, Ministry, and Cabinet; Parliament and elections; the party system; law and the courts; local government; and the British Commonwealth. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **Government and Politics of the Soviet Union.** Evolution, structure, and functioning of the Soviet system of government; the theories, structure, and functioning of the Communist party of the Soviet Union. 3 hours, or $\frac{1}{2}$ or 1 unit.

336. **Governments and Politics in Western Continental Europe.** An analysis of the major governmental systems of continental Europe; the evolution, structure, and functioning of the political institutions of France, Germany, Italy, Spain, Switzerland, and the Scandinavian countries as illustrations of multiparty and dictatorial types of governments. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Government and Politics of China.** An introduction to the governments and politics of modern China. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Governments and Politics in the Middle East.** An analysis of the transformation of Middle Eastern society from Morocco to Iran, as case studies in political modernization; study of politics of the area with special reference to causes and character of modernization, role of leadership, ideologies and institutions, methods and theories for analyzing political systems undergoing fundamental transformation, and implications for U.S. policy. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
339. **Governments and Politics of Sub-Saharan Africa.** Analysis of major political systems in Africa south of the Sahara; emphasis on the development of states and the modification of social and political systems; and a general survey of the area supplemented by a focus on selected countries. Prerequisite: Three hours of political science; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
340. **The German Political System.** Structures and processes of postwar German politics, with primary emphasis on West Germany; special attention to foreign policy formulation and problems (particularly defense), the Berlin issue, reunification, and relations with Eastern Europe. Prerequisite: Knowledge of German helpful but not necessary. 3 hours, or $\frac{1}{2}$ or 1 unit.
342. **Government and Politics in Latin America.** A survey of the origin and development of Latin American political institutions; systems of government; public administrative systems; party government; and international policies of Latin American governments. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **Political Systems and Structures of Latin American Countries.** The political process, generally of selected Latin American countries at different levels of political development; stress on the interaction between political infrastructure and more formal agencies of government; and may include cross-national comparison of the function of such factors as political culture, party system, bureaucracy, or the military establishment. Prerequisite: Political Science 342. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Comparative Communist Systems: Asia.** Examination of the origins and development of modern communism in East Asia. Prerequisite: Junior standing. 3 hours or 1 unit.
346. **Comparative Communist Systems: Eastern Europe.** Analysis of the origins of modern communism and the development of its doctrines; applications of these doctrines in the practices of ruling Communist parties; emphasis on alternates between European and non-European Communist systems, depending on course instructor. 3 hours or 1 unit.
347. **Governments and Politics of Southeast Asia.** Comparative analysis of the political development of the countries of Southeast Asia, the lands to the east of India and south of China; emphasis on the differing approaches to the governing of man and the formation of public policy to be found in these countries; and consideration of economic, social, historical, and geographical influences on political development. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
348. **Government and Politics of Japan.** Introduction to the government and politics of modern Japan. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
349. **Governments and Politics of South Asia.** A comparative analysis of the political development of India, Pakistan, Ceylon, and the lesser lands of South Asia; emphasis on the differing approaches to the governing of man and the formation of public policy to be found in these countries; and consideration of economic, social, historical, and geographical influences on political development. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **Law and Society.** An introductory study from a social science perspective of the nature of law, law makers, and law appliers; the causes or inputs determining law; and the ef-

fects or outputs which law in general produces. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit.

351. **American Constitutional System.** Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate commerce; and jurisdiction of courts. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
352. **Comparative Constitutional Law.** A comparative analysis of the constitutional law cases from a variety of countries with particular emphasis on how the cases have resolved issues relating to civil liberties and the allocation of power among governmental bodies. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
353. **Law and Politics of Poverty.** Study of court cases and other materials dealing with the legal rights and obligations of the poor as tenants, consumers, welfare recipients, employees, arrested persons, family members, legal clients, and political participants; emphasis on the constitutional, political, and sociological aspects of the legal rights involved including the political process through which relevant judicial and legislative policy is made and applied. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
354. **The Judicial Process.** A systematic analysis of legal, evidentiary, environmental, and personal factors that influence judicial decision making, with particular emphasis on the application of the scientific method to the study of judicial behavior. Prerequisite: Political Science 150 and 191. 3 hours, or ½ or 1 unit.
355. **The Constitution and Civil Liberties.** Study of free speech, loyalty in a democratic state, citizenship, freedom of religion, rights of persons accused of crime, and government's responsibility to protect persons from racial and religious discrimination; and special attention to the role of law and judges. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
356. **Public Administration and the Judicial Process.** The scope of administrative powers and their relation to private rights; a comparison of the processes of decision in administrative agencies and in the courts; the interests served by each; the impact of judicial review of administrative decisions upon administrative procedure and policy; the constitutional and statutory bases of review; and the legal accountability of public officers versus political accountability. Prerequisite: Political Science 305, 351, or 361, or consent of instructor. 3 hours, or ½ or 1 unit.
357. **Law and Politics of Environmental Protection.** Study of court cases, legislation, and social science materials dealing with air, water, noise, and waste pollution and conservation; particular emphasis on the political factors involved. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
359. **Jurisprudence.** Nature and sources of law; law and the state; law and justice; and evolution, arrangement, and subject matter of law. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
361. **Introduction to Public Administration.** Development of administrative organization; administration and the executive, legislature, and judiciary; principles of organization, including line and staff relationships; the staff services of finance and personnel; and formal and informal control. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.
362. **Administrative Organization and Policy Development.** Dynamics of policy formulation in public administrative agencies; current developments in organizational theory and their significance for public administration; origin of public administrative organizations; interpersonal behavior; large-scale organizations and centralization; external support and opposition; and policy formation and problems of compliance. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or ½ or 1 unit.
363. **Comparative Administration.** Study of modern bureaucratic organization by means of the comparative method; special reference to the bureaucracies of various countries in different stages of industrialization; and the cultural bases of administrative behavior. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit.

366. **Tools of Public Management.** A critical survey of the tools of analysis available to overhead functions of public management in key areas of decision; emphasis on personnel administration and manpower utilization; budgetary processes and fiscal controls; and several methods of administrative analysis: organizational studies, procedures engineering, information processing, and operations research. Prerequisite: Political Science 361 or consent of instructor. 3 hours or 1 unit.
371. **World International Organization.** General development and basic principles of world organization; principles, structure, methods, and actual operation of international governmental institutions; and special attention to the United Nations and related agencies and to their evolution from the League of Nations system. 3 hours, or $\frac{1}{2}$ or 1 unit.
372. **Regional International Organization.** Descriptive and comparative analysis of various regional international organizations, their role in contemporary world politics and relationship to the United Nations system; structure, functions, and accomplishments of the North Atlantic Treaty Organization, Southeast Asian Treaty Organization, Organization of American States, and other regional international organizations. 3 hours, or $\frac{1}{2}$ or 1 unit.
377. **International Communications.** Same as Communications 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; and government-industry relations in communications. 3 hours or 1 unit.
380. **Comparative Foreign Policies.** An analysis of the formulation and substance of the foreign policies of select nations of the world. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
381. **American Foreign Relations.** Participation in international affairs; presidential initiative; development and organization of the Department of State; diplomatic intercourse; consular service; treaty-making power; and development of foreign policy. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Contemporary American Foreign Policies.** Study of the major foreign policy decisions currently confronting the United States government: analysis of background, principal issues, and alternative actions; formulation of policies. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Soviet Foreign Policy.** Survey of Soviet foreign policy from 1917 to the present, with emphasis upon the forces shaping this policy; special attention to the interplay of ideology and national interest in policy formulation. 3 hours, or $\frac{1}{2}$ or 1 unit.
384. **International Relations.** Examination of contemporary international systems in terms of the types of actors and their goals, various structures of power, and the mechanisms of allocating resources and containing conflict. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **International Law.** Nature, source, and development of international law and certain basic rights and obligations of the subjects thereof. Prerequisite: Senior standing, or junior standing with 6 hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
386. **International Law.** Responsibility, intercourse, and redress of differences between states. Prerequisite: Senior standing, or junior standing with 6 hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
387. **National Security Policy.** Examination of the organization and formulation of current American defense policy; the theory and practice of deterrence, with special reference to American and Soviet military strategy; and the problems of disarmament and arms control. 3 hours, or $\frac{1}{2}$ or 1 unit.
388. **The Military and Politics.** The role of the military in national and international policies, with special attention given to theories of war and peace, civil-military relations, the military and the political development of Western and non-Western states, and the nonmilitary uses of the military. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Chinese Foreign Policy.** An analysis of the formulation, substance, and conduct of Chinese foreign policy, with emphasis on the period since 1949; special attention to the

forces shaping Chinese policy. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

390. **Methods of Political Analysis.** Presentation of the analytic processes in the development of concepts, hypothesis, and theories; discussion of the derivation, formulation, and specification of research problems to be related to basic methodologies and modes of analysis; and applications to political science. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
392. **Socialist Political Theory.** Origins, development, and recent modifications of socialist theory from the late eighteenth century to the present; examination of each contribution in terms of its goals, efficacy, and subsequent influence; and discussion including Rousseau, Hegel, the Utopians, Marx and Engels, Anarcho-syndicalists, Lenin, Luxemburg, Trotsky, Mao, Guevara, and Garaudy. Prerequisite: Sophomore standing. 3 hours or 1 unit.
393. **Classical Political Theory.** A consideration of major works of Greek and Roman political theory, and especially of their relevance to modern political analysis and action. 3 hours, or $\frac{1}{2}$ or 1 unit.
394. **Medieval Political Theory.** The development of political theory from the Church Fathers to the sixteenth century: Augustine, Thomas Aquinas, Dante Alighieri, Marsiglio of Padua, Machiavelli, Thomas More, and others; conflicts of church and state, theories of natural law, natural rights, kingship, legitimacy, popular sovereignty, and representative government. 3 hours, or $\frac{1}{2}$ or 1 unit.
395. **Modern Political Theory.** A critical analysis of political theories from the sixteenth century to the present; focus on the development of such concepts as the nature of man, the role of the state, justice, legitimacy, obligation, individual rights, equality, and mechanisms of maintenance and change. 3 hours, or $\frac{1}{2}$ or 1 unit.
396. **Contemporary Political Theory.** Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; and antidemocratic thought and totalitarian regimes. 3 hours, or $\frac{1}{2}$ or 1 unit.
397. **American Political Theory.** Survey of American political thought from colonial times to the present. 3 hours, or $\frac{1}{2}$ or 1 unit.
398. **Theory and Practice of Democratic Government.** Theories of the nature and conditions of democracy; comparison and analysis of contemporary democratic institutions. Prerequisite: Political Science 150 or 191. 3 hours, or $\frac{1}{2}$ or 1 unit.
400. **Selected Topics in Political Theory.** Reading, analysis, and discussion of selected topics of political theory. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
401. **History of Political Theories.** Reading and analysis of the leading political thinkers from the Greeks to the middle of the seventeenth century. 1 unit.
402. **History of Political Theories.** Readings and analysis of the leading political thinkers from the middle of the seventeenth century to the present. 1 unit.
406. **Municipal Administration.** Position of cities in American governmental systems; governmental interrelationships; powers; services; and current municipal problems. 1 unit.
412. **Problems in State Government.** Research in selected topics in American state government. 1 unit.
420. **Formation of Public Policy.** Same as Labor and Industrial Relations 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, and judicial activity. 1 unit.
423. **Proseminar in American Politics.** An intensive analysis of major institutions and processes of American politics (national, state, and local); research on selected topics in American government. 1 unit.
425. **Personality and Political Process.** Rationality and its limits in political processes; the functions of symbols and myth in politics; political involvement and quiescence; and

nonrational elements in legislation and administration. Prerequisite: Consent of instructor. 1 unit.

426. **Political Parties.** Special problems in political parties; methods and materials of research in this field. 1 unit.
427. **Psychological Bases of Political Behavior.** Introduction to the relationships of psychological mechanisms and life history factors to individual or group political behavior; topics include national loyalty and ideology, mass publics and political involvement, political authority, and individual compliance. 1 unit.
428. **Multivariate Analysis for Political Scientists.** Applied use of extended analysis of variance; multiple classification analysis, factor and small-space analysis, causal analysis, multiple regression, and selected topics for research. Prerequisite: Sociology 413 or 387, and Political Science 497, or consent of instructor. 1 unit.
430. **Proseminar in Comparative Politics.** Comparative political analysis in the context of the evolution of the social sciences and modern political science, with emphasis on theories of political action and their function in contemporary comparative studies. This course is designed as an introduction to area-oriented seminars and generally is a prerequisite for them. 1 unit.
431. **Problems of British Government.** Special topics relating to British government. 1 unit.
435. **Problems in the Government of Soviet Russia.** Special topics relating to the government of the Soviet Union. 1 unit.
437. **Problems in Chinese Politics and Government.** Research in selected topics relating to the political system of China. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
439. **Problems of African Politics and Government.** Analysis of political problems of African states. 1 unit. May be repeated to a maximum of 2 units.
440. **Comparative Politics and the Political Process.** The comparative study of selected national political systems or of specific institutional forces that influence the making and application of public policy in several countries. The countries studied and the legal and extralegal political agencies considered vary according to the person conducting the seminar. 1 unit. May be repeated to a maximum of 3 units.
441. **Politics in the Developing States.** Examination of the political processes in the developing countries; examination of the general problems arising in the transition from traditional societies to modern industrial states in order to describe the typical patterns of political change; and special attention given to contemporary literature and studies. Prerequisite: Political Science 430; consent of instructor. 1 unit.
442. **Problems of Latin American Politics and Government.** Special topics relating to Latin American politics and government; individual countries may be studied or comparative analysis of particular political and governmental functions or problems may be undertaken. Prerequisite: Political Science 430 and 441, or equivalent. 1 unit. May be repeated to a maximum of 2 units.
446. **Problems of Southeast Asian Politics and Government.** Research in the political systems of Southeast Asia. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
448. **Problems in Japanese Politics and Government.** Study of scholarly literature on modern Japanese politics and examination of selected problems in modern Japanese politics. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
449. **Problems of South Asian Politics and Government.** Research in the political systems of South Asia. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
450. **Contemporary Governmental Problems.** Special problems of current importance designed especially for students not majoring in political science. 1 unit. May be repeated to a maximum of 3 units.

- 451. Constitutional Law.** Research in selected topics in the American constitutional system. Prerequisite: Political Science 351 or equivalent. 1 unit.
- 453. Law, Policy, and Social Science.** The application of social science research techniques to improving legal procedure and legal substance; emphasis on constitutional law and other public law subjects, but also consideration of other fields of law. 1 unit.
- 460. Organizational Sciences, I.** Same as Business Administration 410, Psychology 453, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; in addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.
- 461. Organizational Sciences, II.** Same as Business Administration 411, Psychology 454, and Sociology 457. Introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Political Science 460. 1 unit.
- 465. Problems in Administrative Management.** Analysis of methods of applying administrative principles and procedures to operating problems in government agencies, such as methods of administrative coordination and control, intergovernmental cooperation, legislative-administrative relations, the organization of regulatory functions, and review of administrative decisions. Prerequisite: Political Science 361 or consent of instructor. 1 unit.
- 466. Current Administrative Theory.** A discussion of some recent trends in administrative opinion and practice on such questions as agency structure and functional activities; field and regional organization and relations; the role and functions of the executive; the process of decision making; the relations of line and staff activities; the communication and execution of policies and programs; and employee relations. 1 unit.
- 469. Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations, Social Work, and Educational Administration 497. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
- 471. Problems in International Organization.** Methods and materials of research in international organization; special topics, such as disarmament, security, procedural problems in the United Nations, economic and social problems, and amendment and revision of the Charter. 1 unit.
- 480. Scope and Theory in International Relations.** Deals with the field of international relations, its relationship to political science and the other social sciences; treats the development of the field by examining major theories and approaches that have characterized it in the past, but with emphasis on contemporary theories and concepts. 1 unit.
- 481. Methodology in International Relations.** Deals with major research methodologies in contemporary international relations; includes case studies, aggregate data, content analysis, survey research, gaming and simulations, and causal modelling; and presumes knowledge of basic international relations theory. Prerequisite: Political Science 480. 1 unit.
- 482. Foreign Relations of the United States.** Special problems in the development and conduct of American foreign policy. 1 unit.
- 483. United States Foreign Policies.** Study of selected current problems in foreign policy; use of power; problems of negotiation; relations with new states; and foreign aid. 1 unit.
- 484. International Relations: Special Problems in Theory and Research.** Advanced seminar on special topics in international relations. Prerequisite: Political Science 480 or

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481, or consent of instructor. 1 unit. May be repeated under different instructors for a maximum of 3 units.

490. **Proseminar in Political Behavior, I.** Interdisciplinary approaches to the analysis of political behavior; formation of opinions, interests, roles, and personality; applications of organization theory to political institutions; applications of conflict and bargaining theory to political processes; and systematic studies of the distribution of values. 1 unit.
491. **Proseminar in Political Behavior, II.** Continuation of Political Science 490. Prerequisite: Political Science 490. 1 unit.
492. **Problems of Explanation in Social Science.** Special topics in the methodology of social sciences, especially theory formation and theory testing. 1 unit.
493. **Research in Selected Topics.** Research in selected topics by arrangement with the instructor. $\frac{1}{2}$ to 3 units.
494. **Systematic Social Criticism.** Problems of social criticism in contemporary society; relation of social criticism and social policies. Prerequisite: Political Science 492 or consent of instructor. 1 unit.
495. **Scope and Methods of Political Science.** Definitions of the scope and subject matter of political science; methodological issues in political science; major conceptions of methodology as embodied in current leading studies of politics; and the present state of research in political science. 1 unit.
496. **Political Concepts: Formulation and Measurement.** Indicates the relevance of certain research techniques for answering questions of concern in political science; indicates the range of tools available to the student; and includes discussion of problems in concept formation. Current methods of concept measurement are presented to the student in the context of political research problems. Prerequisite: Consent of instructor. 1 unit.
497. **Research Design and Techniques.** Introduction to problems of research design, data collection, data analysis and interpretation, sampling, and some simple measures of statistical association and significance. Prerequisite: Political Science 496. 1 unit.
498. **The Logic of Political Inquiry: Selected Topics.** Application of analytic principles and procedures developed in Political Science 495 to such topics as patterns of explanation; current theoretical perspectives; group theory, functionalism, systems theory, decision making, simulation, etc; the logic of judicial decisions; and justifications of political ideologies. This list is not exhaustive, nor will all of these topics be included each semester. Prerequisite: Political Science 495. 1 unit. May be repeated to a maximum of 2 units.
499. **Thesis Research.** 0 to 4 units.

PORTUGUESE

(See Spanish, Italian, and Portuguese)

PSYCHOLOGY

Head of Department: Professor J. E. McGrath

Department Office: 315 Psychology Building, Champaign

100. **Introduction to Psychology.** Study of human behavior with special reference to perception, learning, memory, thinking, emotional life, and individual differences in intelligence, aptitude, and personality; emphasis on the scientific nature of psychological investigations; and discussion of research methods and the relation of their results to daily life and everyday problems. Lectures, discussions, and five hours of participation in lab-

- oratory experiments. Not open to students electing Psychology 103 or 105. 3 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
101. **Theory and Practice of Psychological Research.** Consideration of research methods and problems of research design in psychology; participation in ongoing research of the staff of the department. Prerequisite: To be taken concurrently with Psychology 100, 103, or 105, or with the consent of the academic adviser of the Department of Psychology. 1 hour. May not be repeated.
 103. **Introduction to Experimental Psychology.** An in-depth survey of basic topics in experimental psychology; emphasis on conditioning, learning, perception, and animal behavior with stress placed on the biological aspects of these problems. Lecture and laboratory. Not open to students electing Psychology 100 or 105. 4 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
 105. **Elements of Psychology.** Description and explanation of the psychological principles of everyday living, with emphasis on how behavior is motivated, how individuals learn intelligent behavior, personality, and applications of psychology to various social issues. Lectures, discussions, and five hours of participation in psychological experiments. This course may be substituted for Psychology 100 when the latter is listed as a prerequisite or a recommended elective. For placement purposes, enrollment is limited to students whose ACT composite score is 21 and below. Not open to students electing Psychology 100 or 103. 4 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
 135. **Statistical Thinking in Psychology.** The application of principles of descriptive and inferential statistics to psychological phenomena. Credit is not given for Psychology 135 in addition to Economics 171, Mathematics 161, or Psychology 235. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 143. **Biological Bases of Human Behavior.** Same as Anthropology, Home Economics, and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior; topics include communication and social organization, and parental, sexual, and aggressive behavior. 3 hours.
 198. **Freshman Seminar in Psychology.** Lecture-discussions devoted to the in-depth study of a topic of current interest in psychology. The specific topic studied is elected by the students from those topics falling within the area of competence of the instructor. The instructor rotates from one semester to another so that the general area changes as the instructor changes. Prerequisite: Open only to James Scholars. There may be additional prerequisites from time to time as the topic of the seminar changes. For example, there may be a mathematics prerequisite for a seminar in mathematical psychology or a biological science prerequisite for a seminar in physiological psychology. 3 hours.
 199. **Undergraduate Open Seminar.** 0 to 9 hours.
 201. **Introduction to Social Psychology.** Systematic study of social factors in individual and group behavior; attention to social perception, motivation, and learning; attitudes, norms, and social influence processes; the development and dynamics of groups; and the effects of social and cultural factors on the individual. Credit is not given for both Psychology 201 and Sociology 201. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 202. **The Application of Social Psychology to Contemporary Issues.** An exploration of selected social issues using the methodological and conceptual viewpoints of social psychology as analytical tools; different sections cover different topics as listed in the Timetable. Prerequisite: Psychology 100, 103, or 105. 3 hours.
 211. **Physiological Psychology.** Survey of classical and modern concepts of the physiological basis of behavior; particular emphasis on the sensory systems, regulatory mechanisms, and learning. Prerequisite: Psychology 100, 103, or 105; Physiology 103 or 106, or Zoology 104. 4 hours.
 216. **Child Psychology.** Study of the psychological development of the child. Prerequisite: Psychology 100, 103, or 105. 3 hours.

- 217. Comparative Development.** Survey of phylogenetic and ontogenetic development of behavior. The first part of the course considers the comparative psychology of representative phyla, with special emphasis on the development of sensorimotor coordination, motivation, and learning. The second half of the course is concerned with development of behavior in the individual organism, with most attention devoted to behavioral changes during the life span of vertebrate organisms. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 230. Perception and Sensory Processes.** Survey of the experimental psychology of sensory and perceptual processes and behavior; emphasis on the contribution of behavior science to understanding subjective experience of the physical and social environment. Prerequisite: Psychology 100, 103, or 105; Physiology 103 or Zoology 104; consent of instructor or academic counselor of the Department of Psychology. 3 hours.
- 235. Statistical Methods in Psychological Research.** Development of skill and understanding in the application of statistical methods to problems of psychological research. Prerequisite: Psychology 100, 103, or 105; Mathematics 111 or equivalent. 4 hours. Students who have credit in Economics 171, Mathematics 161, or Psychology 135 receive 1 hour credit.
- 245. Industrial Psychology.** A systematic study of the application of psychological methods and principles in business and industry; emphasis on personnel selection and factors influencing efficiency. Prerequisite: Psychology 100, 103, or 105; a course in statistics. 3 hours.
- 246. Vertebrate Social Organization.** Same as Anthropology, Sociology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
- 247. An Introduction to Behavior Genetics: Lecture.** Same as Anthropology 247. Examination of relations between genetic mechanisms, population structure, race, and individual differences in behavior; survey of research and future possible behavior-genetic analyses; and applications such as genetic counseling. Prerequisite: Psychology 100, 103, or 105, or Biology 100, or Physiology 103, or Zoology 104; and a course in statistics which may be taken concurrently. 3 hours.
- 248. Learning.** Survey of basic phenomena in learning, emphasizing experimental data from both animal and human research. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 250. Psychology of Personality.** A systematic study of the development, dynamics, and structure of personality, including major contributions to methodology, theory, and empirical research. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 258. Human Performance in Man-Machine Systems.** Examination of equipment and training variables that influence the human operator in man-machine systems; main topics include nature of man-machine systems; capabilities of men and machines; simulation for design decision; task analysis methods to determine human requirements in a system; and research and principles for the design and use of symbolic and pictorial displays, control systems, and simulators for training. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 291. Honors.** Prerequisite: Junior standing; consent of instructor. 2 to 4 hours.
- 292. Honors.** Prerequisite: Psychology 291. 2 to 4 hours.
- 293. Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point of 3.75. 2 to 4 hours.
- 294. Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point average of 3.75. 2 to 4 hours.

306. **Quantitative Methods, I.** A lecture and laboratory course in the development and application of quantitative methods in psychological research. Prerequisite: Twelve hours of psychology, including Psychology 135 or equivalent. 4 hours or 1 unit.
307. **Quantitative Methods, II.** Continuation of Psychology 306. Prerequisite: Psychology 306. 4 hours or 1 unit.
311. **Laboratory in Physiological Psychology.** Research on classical and current problems; emphasis on the nervous and endocrine systems in information processing and in the regulation of behavioral adaptation; and examples from sensation, perception, motivation, emotion, and learning. Laboratory. Prerequisite: Psychology 211. 4 hours, or $\frac{1}{2}$ or 1 unit.
324. **Psychology of Thinking.** Survey of problems, experimental methods, and research findings in human thinking; emphasis on concept formation, problem solving and decision making, and creativity. Prerequisite: Psychology 235. 3 hours or 1 unit.
325. **Psychology of Language.** Survey of theory and research in the psychology of language; topics include relation of linguistics and psychology; language development; and influence of language on perception, memory, and thought. Credit not given for both Psychology 325 and Linguistics 325. Prerequisite: Six hours of psychology or consent of instructor. 3 hours or 1 unit.
326. **Motivation and Emotion.** The nature and development of emotion, attitude, and motive, and the role of these processes in social adjustment. Prerequisite: Six hours of psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **Experimental Psychology, I.** Survey of problems, experimental methods, and research findings in the fields of psychophysics, sensory processes, perception, judgment, and thinking. Prerequisite: Psychology 230; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or $\frac{1}{2}$ unit.
331. **Experimental Psychology, II.** A lecture-laboratory course concentrating on research problems and methodology in both animal and human learning; concentration on laboratory techniques and reporting experimental results. Prerequisite: Psychology 248; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or $\frac{1}{2}$ unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Sociology 332. Lecture and laboratory in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185. 4 hours, or $\frac{1}{2}$ or 1 unit.
333. **Research Methods in Social Psychology: Natural Settings.** Methods and techniques of social psychological research in natural settings. Students formulate and carry out research problems using procedures appropriate for research in natural settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235, or Sociology 184 and 185. 4 hours or 1 unit.
335. **Mathematical Formulations in Psychological Theory.** Illustration of mathematical formulations by studying quantitative treatments of various psychological processes; emphasis on learning theory, psychophysical laws, and other selected topics; and the development of simple mathematical tools as required. Prerequisite: Elementary statistics of probability, elementary calculus, and 6 hours of psychology, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Abnormal Psychology.** An introduction for preprofessional students to the psychological aspects of behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. Prerequisite: Six hours of psychology; junior standing except for those in the premedical curriculum who may take the course as second-semester sophomores with 4 hours of psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
339. **Community Psychology.** Introduction to the concepts and the application of psychological knowledge to community problems; stress on a broad definition of mental health, a social learning, and a preventive, rather than an ameliorative, approach to community problems; and emphasis on community organization and innovations in the delivery of services to those populations which normally fall outside the service net-

work, e.g., the poor, minority groups, and other "marginal groups." Prerequisite: Sophomore standing; Psychology 100, 103, or 105. 3 hours, or $\frac{1}{2}$ or 1 unit.

342. **Behavior-Genetic Analysis.** Same as Zoology 350 and Anthropology 342. Concepts, methods, and problems in the analysis of relations between genetic systems and animal and brain behavior. Prerequisite: Anthropology 240, Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or $\frac{3}{4}$ or 1 unit.
345. **Comparative Psychology.** Animal behavior with particular reference to the behavior of vertebrates. Prerequisite: Six hours of psychology, or Psychology 100, 103, or 105; a course in zoology. 4 hours, or $\frac{1}{2}$ or 1 unit.
347. **Behavior Genetics Laboratory.** Same as Anthropology 337. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Concurrent registration in Psychology 247. 2 hours or $\frac{1}{2}$ unit.
348. **Theories of Learning.** A critical analysis of selected theories of learning; consideration of problems of theory construction in the context of past controversies in learning as well as recent theories of animal and human learning. Prerequisite: Psychology 248 or Educational Psychology 211. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **Research and Theory in Personality.** Study of personality for the advanced student in psychology; consideration of problems of measurement, development, structure, dynamics, and change of personality; and study of examples of current theory and research as illustrations of an objective approach to the field. Prerequisite: Psychology 100, 103, or 105; Psychology 235 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
352. **Attitude Theory and Change.** Same as Communications 352 and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Psychology 201 or Sociology 201, or a comparable course of introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Individual Social Behavior.** Survey of major theories and research on perceptual, cognitive, learning, motivational, and environmental factors that influence the social behavior of the individual. Prerequisite: Psychology 201, 216, or 250, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
354. **Interpersonal Processes.** The nature of interpersonal transactions; theories and methods for their investigation; and consideration of both individual and social determinants of such transactions. Prerequisite: Psychology 201. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Industrial Social Psychology.** Same as Labor and Industrial Relations 355. Social psychological research and theory applied to industrial problems; emphasis on interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **Human Factors in System Design.** Evaluation of the capabilities and limitations of human operators in the design of man-machine systems; applications of signal detection theory, information theory, servo theory, and Bayesian statistics to human sensing, monitoring, decision making, information processing, and communicating capabilities. Prerequisite: Psychology 258; one course in statistics or equivalent. 3 hours or 1 unit.
357. **Psychology of Industrial Conflict.** Same as Labor and Industrial Relations 357. An analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Offered in the special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit. Undergraduate majors in psychology may not receive credit in this course.
359. **The Social Psychology of Organization.** Same as Sociology 359. Analysis of the interrelationships between social and psychological factors and organizational structure and process; emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Psychology 355 or Sociology 322. 3 hours or 1 unit.

360. **Modern Viewpoints in Psychology.** A brief survey of early theoretical psychology followed by an examination of contemporary "behavior theory," Gestalt theory, and psychoanalytic theory as conceptions of man and as approaches to the study of learning, perception, personality, and social behavior. Prerequisite: Senior standing; 9 hours of psychology with an average grade of "B;" consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **Advanced Developmental Psychology.** Theory and research on psychological development from birth through adolescence; maturation of behavior systems; the role of social learning in development; the effects of early experience on personality development; and critical stages in development. Prerequisite: Psychology 216 or 217; a course in statistics. 3 hours, or $\frac{1}{2}$ to 1 unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Sociology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology; emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment; regulation of population; and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper, the credit may be 3 to 5 hours.
371. **Psychological Factors in Political Behavior.** An application of psychological methods and theories to the study of political behavior; attention to research methods and to content problems in voting behavior and national security policy. Prerequisite: Six hours beyond 100-level courses in psychology, political science, or sociology. 3 hours, or $\frac{1}{2}$ or 1 unit.
373. **Theory and Method in the Cross-Cultural Study of Individual Social Behavior.** Same as Anthropology 373. Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception; emphasis on methodological limitations and contributions of cross-cultural study; and discussion of current problems and research. Prerequisite: Six hours or psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Sociology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Psychology 369. 4 hours or 1 unit.
390. **Psychological Tests and Measurements.** The measurement of human behavior in psychological studies; the construction and use of psychological tests; introduction to tests of intelligence, achievement, personality, and interest; and practice in test construction, administration, and validation. Lectures and laboratory. Prerequisite: A knowledge of statistics equivalent to that from Psychology 235. 4 hours or 1 unit.
393. **Laboratory in Primate Social Behavior.** Same as Anthropology 393 and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

The prerequisites stated below apply to graduate majors in 448 psychology. Students minor-ing in psychology may, by special 449 permission of instructors, enroll in certain of these courses 450 without having met all the prerequisites. 451

402. **Systematic Psychology.** A critical analysis and comparison of modern and contemporary psychological systems. Prerequisite: Twelve hours of psychology. 1 unit.

- 403. Proseminar in General Psychology, I.** A brief historical introduction to modern psychology; fundamentals of differential psychology, including the measurement of intelligence, aptitudes, and personality; motivation, emotion, and mechanisms of defense; psychological development; and social behavior. Prerequisite: Twelve hours of psychology. 1 unit.
- 404. Proseminar in General Psychology, II.** Sensory processes; perception; fundamental processes in learning; learning theory; special aspects of human learning; language behavior; thinking; and logical aspects of psychological theory. Prerequisite: Twelve hours of psychology. 1 unit.
- 408. Design of Experiments in Psychology.** Advanced experimental designs in psychological research; special methods of data analysis. Prerequisite: Psychology 307. 1 unit.
- 409. Psychological Scaling.** Same as Sociology 409. Scaling theory and methodology; emphasis on measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit.
- 411. Advanced Physiological Psychology.** Detailed examination of the physiological mechanisms in behavior; emphasis on research methodology and contemporary literature in the physiology of motivation, learning, perception, and emotion; and includes laboratory demonstrations and problems. Prerequisite: Twelve hours of psychology, including Psychology 311 or equivalent. 1 unit.
- 413. Computer Applications in Social Science Statistical Research.** Same as Computer Science 413 and Sociology 413. Computer procedures for the analysis of sociological and psychological data; probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387. 1 unit.
- 414. Experimental Personality Research.** A laboratory training course emphasizing physiological, perceptual, learning, and genetic approaches to the experimental study of personality; critical surveys of recent research literature combined with laboratory training in representative techniques. Prerequisite: Psychology 307 and 404; consent of instructor. 1 unit.
- 415. Experimental Sensory Psychology.** A systematic study of sensory processes, including vision, audition, gustation, olfaction, and somesthesia; emphasis on experimental methods, research findings, and theory. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.
- 416. Perception.** Systematic study of methods and research findings in the field of human perception, together with an evaluation of theoretical interpretations. Prerequisite: Twelve hours of psychology. 1 unit.
- 417. Experimental Psychology of Learning, I: Basic Processes.** Study of experimental investigation of basic learning processes; emphasis on the nature of the problems, experimental procedures, and theoretical significance. Prerequisite: Twelve hours of psychology. 1 unit.
- 418. Experimental Psychology of Learning, II: Human Learning.** Data and theories of verbal learning; verbal mediators and their functions in learning and retention; transfer of training; short-term and long-term memory; and conceptualizations of the forgetting process. Prerequisite: Twelve hours of psychology or consent of instructor. 1 unit.
- 419. Advanced Comparative Psychology.** A critical survey of techniques, results, and problems in the study of animal behavior and human behavior from the comparative-evolutionary point of view; laboratory demonstrations and individual research problems. Prerequisite: Twelve hours of psychology or biology. 1 unit.
- 424. Developmental Psycholinguistics.** Same as Communications 424 and Linguistics 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
- 425. Psycholinguistics.** Same as Communications 425 and Linguistics 425. A critical survey of methods and theories in the psychological study of the communication process; emphasis on linguistic, information-theory, and learning-theory approaches; psycholin-

- guistic analysis of language decoding and encoding; and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Communications 426 and Linguistics 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course plan, execute, and report an original piece of research in this area. Prerequisite: Psychology 425; consent of instructor. ½ or 1 unit.
427. **Engineering Psychology.** Experimental psychology applied to the study of man-machine systems; study of psychological factors in the design of equipment, systems, and environments for safe, efficient, and comfortable performance by man. 1 unit.
428. **Higher Process.** Examination of method, theory, and research in the study of thinking; status of cognition as a construct; verbal control of behavior; concepts, problem solving, attention, language, and thought; and cognitive process as a source of motivation. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.
429. **Second Language Acquisition and Bilingualism.** Same as Linguistics 429. Examination of the field from a psycholinguistic perspective; topics discussed include first versus second language acquisition; the nature of language aptitude and competence; methods of second language teaching; the nature of bilingualism; and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit.
431. **Psychological Measurement in Industry.** Application of psychometric methods and the finding of differential psychology to the selection, classification, and performance evaluation of industrial personnel. Prerequisite: Psychology 307 or equivalent. 1 unit.
435. **Motivation and Morale in Industry.** Same as Labor and Industrial Relations 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; and modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
436. **Mathematical Models in Psychology.** Recent developments in mathematical models in psychology; special emphasis on human learning, higher processes, and modern psychophysics. Prerequisite: One year of calculus and Psychology 306 and 307, or consent of instructor. ½ or 1 unit.
438. **Introduction to Clinical Psychology, I.** Introduction to clinical psychology as a science and profession; lectures, discussion, demonstrations, and field observations provided for an overview of clinical psychology. Prerequisite: Graduate standing in clinical psychology; consent of instructor. 1 unit.
439. **Introduction to Clinical Psychology, II.** Continuation of introductory sequence in clinical psychology; discussion of logical issues in assessment, disposition, and behavior change; and initiation of preliminary training in interview and observational methods. Prerequisite: Psychology 438. 1 unit.
440. **Functional Analysis of Behavior.** A lecture and laboratory course in the principles, analysis, and control of behavior; emphasis on operant and respondent conditioning as means of behavior change. Prerequisite: Consent of instructor. ½ unit.
441. **Personality and Behavior Dynamics.** Description of the cross-sectional structure of personality, the basic principles of behavior dynamics, and the determinants which shape personality development; special topics include typologies, trait measurement, conflict and anxiety, and mechanisms of defense. Graduate credit is not allowed for both Psychology 350 and 441. Prerequisite: Twelve hours of psychology. ½ unit.
442. **Behavior Disorders.** A review of the experimental-clinical literature concerning behavior disorders, with special reference to classification and etiology. Prerequisite: Psychology 338 and 440; consent of instructor. ½ unit.
443. **Psychodiagnostics, I.** Instruction and practice in the administration and interpretation of individual tests of general intelligence, special abilities, and achievement. Prerequisite: Twelve hours of psychology, including Psychology 390 or equivalent; Psychology 439. 1 unit.

444. **Psychodiagnostics, II.** Instruction and practice in the administration and interpretation of tests and other instruments used in the assessment of personality; special emphasis on projective techniques. Prerequisite: Psychology 443; consent of instructor. 1 unit.
445. **Behavior Modification.** A critical survey of issues, principles, practice, and research related to modifying human behavior; covers psychotherapeutic and somatic approaches; symptomatic relief and personality-restructuring; goal-orientations; and individual family, group, milieu, and preventive community intervention. Prerequisite: Psychology 444; concurrent registration in Psychology 447 strongly recommended. ½ unit.
446. **Laboratories in Clinical Psychology.** Intensive practice in techniques of clinical assessment and behavior modification with emphasis on recent innovations; small sections of the course formed according to the specialized interests of students and staff. Prerequisite: Psychology 445. ½ to 1 unit.
447. **Internship.** Supervised field experience in clinical psychology. Prerequisite: Consent of instructor. 0 to 4 units.
449. **Medicine in Clinical Psychology.** Introduction to areas of medicine and the organization of medical services as appropriate to the practice of clinical psychology; presentation of medical facts, procedures, and viewpoints to enhance the mutual contributions and collaborative efforts of medicine and clinical psychology. Prerequisite: Second-year graduate standing in clinical psychology or consent of instructor. ½ unit.
451. **Theory and Method in Social Psychology, I.** First of two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology; participation and seminar presentations by social psychology program faculty. Student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Admission as a graduate student to the social psychology program, or consent of instructor. 1 unit.
452. **Theory and Method in Social Psychology, II.** Second of a two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology; participation and seminar presentations by social psychology program faculty. Each student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Psychology 451. ½ unit.
453. **Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; critical examination of the capacities and limitations of the various fields to make contributions to the study of organizations, in addition to examination of the subject matter content of various disciplines. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.
454. **Organizational Sciences, II.** Same as Business Administration 411, Political Science 461, and Sociology 457. Introduction to the principal theories and important empirical research in various disciplines that study organizations; critical examination of the capacities and limitations of the various fields to make contributions to the study of organizations, in addition to examination of the subject matter content of various disciplines. Prerequisite: Business Administration 410. 1 unit.
455. **Research Methods in Organizational Psychology.** Discussion and analysis of strategies, methods, and techniques of organizational psychological research; emphasis on methods for researching behavioral determinants within interdependent organizational roles. Prerequisite: Psychology 355 or 359, or consent of instructor. 1 unit.
456. **Attitude Measurement and Behavioral Prediction.** Same as Communications 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction; emphasis on the attitude concept and the valid-

ity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.

457. **Theory and Research in Organizational Psychology.** Theory and research on the psychological processes involving the demands of organizations on the behavior of individuals; emphasis on the processes of power, authority, influence, leadership, communications, decision making, and organizational change. Prerequisite: Psychology 455 or consent of instructor. 1 unit.
458. **Advanced Problems in Attitude Research.** Intensive analyses of recent developments in attitude theory and research; emphasis on the attitude-behavior relationship; and examination of theories of attitude and attitude change with respect to their utility in predicting and changing social behavior. Prerequisite: Psychology 352 or 456. 1 unit.
459. **Advanced Problems in Research on Groups.** Intensive examination of current research and theory on structure, process, and performance of groups; critical examination of recent research and theoretical literature; and development of research designs for related issues in the field. Prerequisite: Psychology 451 or consent of instructor. 1 unit.
460. **Motivation and Personality Development in Children.** Theory, method, and research on the interaction of motivational, personality, and learning processes and development in children; emphasis on experimental studies and a social learning theory approach. Class projects involve some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
462. **Human Abilities.** Analysis of individual differences in human abilities, including historical background, measurement methodology, and functional correlates of abilities; consideration of the use of ability measures in both experimental and applied research. Prerequisite: Psychology 307 or equivalent. 1 unit.
463. **Research Methods in Clinical Psychology and Personality.** The logical analysis of clinical inferences and their role in research; problems and methods in the investigation of the development, dynamics, and structure of personality; and research in psychotherapy. Prerequisite: Psychology 306 and 403. ½ unit.
464. **Advanced Problems in the Study of Individual Social Behavior.** An intensive examination of current research into one or more of the following areas: social perception and cognition, social motivation, social learning, and environmental factors in social behavior; critical examination of recent research and theoretical literature, and development of research designs for selected current issues. Prerequisite: Psychology 451; 6 units of psychology. 1 unit.
465. **Learning in Children.** Examination of laboratory investigations of children's learning; emphasis on developmental changes as related to current theories of learning and development; and class projects involving some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
466. **Advanced Personality Theory.** An integration of concepts arising from quantitative, multivariate, and experimental research on personality and requiring facility with precise models; deals with measurement, personality and motivation structure, genetics, physiological determiners, models for family and cultural relations, and structured learning theory; and considers implications of personality theory in clinical, industrial, and educational psychology. Prerequisite: Psychology 306 and 307. 1 unit.
467. **Personality Assessment.** Methods and theory in the quantitative assessment of personality; review of research findings and trends. Prerequisite: Psychology 307 or equivalent. 1 unit.
468. **Contemporary Behavior Theory.** Introduction to modern attempts to formulate scientific theories of behavior; special emphasis on theories concerning the learning process, including the work of Hull, Tolman, and Guthrie. Prerequisite: Six units of graduate credit in psychology; consent of instructor. 1 unit.
469. **Cognitive Development.** Examination of laboratory investigations of cognitive development in children; emphasis on current theories of cognition and language; and class projects involving some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.

- 470. Principles and Methods of Teaching Psychology.** Designed for graduate students in psychology; areas considered include developing course objectives and content; developing and presenting teaching-learning situations; evaluating the attainment of course objectives; advising and counseling students; ethics in teaching; and research problems on the teaching of psychology. Prerequisite: Second-year graduate standing in psychology or consent of instructor. $\frac{1}{2}$ or 1 unit.
- 483. Psychology of Speech and Hearing Disorders, I.** Same as Speech and Hearing Science 483. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to speech disorders; review of research finding and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
- 484. Psychology of Speech and Hearing Disorders, II.** Same as Speech and Hearing Science 484. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
- 485. The Sampling of Human Populations and Social Organizations.** Same as Business Administration 485 and Sociology 485. Covers procedures for selecting samples from and estimating population parameters for human populations and social organizations; treatment of types of sample designs including simple random samples, and stratified and cluster samples, together with random number and systematic selection techniques; and emphasis on the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.
- 490. Individual Research.** For graduate students who wish to conduct research on special problems not included in graduate theses. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
- 492. Psychology of Learning and Instruction.** Same as Educational Psychology 492. An advanced course in the nature and conditions of long-term cognitive learning and retention in classroom and similar situations; intended for doctoral students with a special interest in research leading to the improvement of classroom teaching and learning, in psychological aspects of curriculum research, and in the cognitive aspects of military and industrial training. Prerequisite: Consent of instructor. 1 unit.
- 493. Seminar.** Discussion of current topics in their historical setting, with special emphasis on research problems. Prerequisite: Six units of graduate credit in psychology; consent of instructor. $\frac{1}{2}$ or 1 unit.
- 494. Multivariate Analysis in Psychology and Education.** Same as Educational Psychology 494 and Sociology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements; emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
- 495. Theory of Measurement.** Same as Educational Psychology 495. Logical and mathematical principles underlying test design, construction, and validation; particular emphasis on evaluating reliability of measurement, utility resulting from test-based decisions, and validity of descriptions of individuals. Prerequisite: Educational Psychology 496 or Psychology 307, or equivalent; Educational Psychology 392 or Psychology 390, or equivalent. 1 unit.
- 499. Thesis Research.** 0 to 4 units.

RADIO AND TELEVISION

Head of Department: Professor P. E. Welch

Department Office: 119 Gregory Hall, Urbana

199. **Undergraduate Open Seminar.** 0 to 9 hours.
252. **Television Laboratory.** Designed to acquaint the student with basic television equipment and principles of studio operation; emphasis on the production of laboratory programs with students participating in the various jobs involved in studio production. Prerequisite: Consent of department. 3 hours.
261. **Principles of Radio and Television Broadcasting.** An introductory course in the history of American radio and television broadcasting; comparative broadcasting systems; organization and operation of stations and networks; social and legal responsibilities of radio and television; codes and practices of broadcasting; and an introduction to radio and television audience measurement and survey methods. Prerequisite: Junior standing. 2 hours.
263. **Radio and Television Announcing.** Intensive training in studio procedures and interpretation of radio and television copy, including news, feature scripts, continuity, and commercials. Prerequisite: Consent of department. 2 hours.
267. **Radio Production and Direction.** Study of the principles of planning, casting, rehearsing, and airing varied program types; emphasis on advanced techniques of dramatic production. Prerequisite: Consent of department. 3 hours.
280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Speech Communication 263, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in radio and television for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of department. 2 or 3 hours.
354. **Television Directing.** The theory and techniques of directing the television program; experience in directing laboratory productions. Prerequisite: Radio and Television 252; consent of department. 3 hours or ½ unit.
355. **Television News.** News coverage, script preparation, use of visual materials, and presentation of news programs; attention given to interviews, special events, and news fields of special interest. Prerequisite: Consent of department. 3 hours or ½ unit.
356. **Cinematography for Television.** The equipment and techniques used in the production of films for television, including camera operation, lighting, editing, sound recording, matching, etc. Materials cost approximately \$50.00. Prerequisite: Consent of department. 3 hours or ½ unit.
357. **Broadcast Continuity Writing.** Study of the fundamentals of radio and television continuity writing, including commercial copy, talks, interviews, and music and feature programs. Prerequisite: Consent of department. 3 hours or ½ unit.
360. **Educational Uses of Television and Radio.** Same as Educational Psychology 360. Study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; and experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.
361. **Radio and Television: Television Programs.** Television program history; types, structure, formats, and basic audience appeals; major emphasis on the creative aspects of originating and planning television programs. Prerequisite: Course or experience in television directing and production; consent of department. 3 hours or ½ unit.
362. **Radio and Television Station Management.** Study of the organization and administration of the radio and television staff and station; public relations, personnel manage-

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ment, and station operation; analysis of station and agency relationships, and radio and television sales procedures; methods and media for program and station promotion; and laws and regulations affecting management, financing, and labor relationships. Prerequisite: Radio and Television 261; senior standing; consent of department. 2 hours or ½ unit.

363. **Advanced Dramatic Writing.** Same as Speech Communication 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Radio and Television 280; consent of instructor. 3 hours, or ½ or 1 unit. May be repeated for a maximum of 6 hours or 2 units.
365. **Radio News.** News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services; and processing radio news-service copy. Prerequisite: Journalism 211; consent of department. 3 hours or ½ unit.
366. **Advanced Radio and Television Practices, I.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or ½ unit.
367. **Advanced Radio and Television Practices, II.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or ½ unit.
368. **Radio and Television Regulations.** Federal legislation, with emphasis on Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. Prerequisite: Senior standing; consent of department. 2 hours or ½ unit.
450. **Special Problems in Television.** Project work for advanced students in specific areas of television, including news, advertising, directing, writing, etc. Prerequisite: A television course in the area of specialization; consent of department. ½ to 3 units. A maximum of 3 units permitted toward degree.
462. **Seminar in Radio and Television.** Same as Communications 462. Study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
463. **World Broadcasting.** Same as Communications 463. Study of the broadcast systems used by the nations of the world; alternative and "mixed" systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other countries; implications of such new developments as satellites; and mass and nonmass uses. Prerequisite: Radio and Television 462 or consent of instructor. 1 unit.
490. **Special Topics in Radio and Television.** Prerequisite: Consent of department. ½ or 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in radio and television. 1 or 2 units.

RECREATION AND PARK ADMINISTRATION

Acting Head of Department: Professor J. J. Bannon
Department Office: 104 Huff Gymnasium, Champaign

100. **Leisure: Its Uses and Resources.** Philosophical foundations of leisure and recreation; history of the development of parks and man's organized efforts to meet his leisure

- needs; introduction to present patterns of organized recreation; professional preparation for the field; and evaluation of student skills and experience. 2 hours.
110. **Foundations for Recreation and Park Services.** Introduces the recreation and park administration major to enabling legislation, fiscal concerns, standards for planning, problems of cities, and the relationship of professional organizations to recreation and park services. 2 hours.
 130. **Introduction to Therapeutic Recreation.** Introduction to concepts and principles of therapeutic recreation; types of illnesses and disabilities; settings; programming and services; and role of the therapeutic recreator. 2 hours.
 140. **Principles of Camping.** Objectives, organization, techniques, counseling, activities, and evaluation. 3 hours.
 141. **Introduction to Outdoor Education and Recreation.** Philosophy and principles; programs and methods used by various types of institutions; and field experience. Prerequisite: Recreation 100 or consent of instructor. 2 hours.
 180. **Recreation Program Laboratory, I.** Survey of a number of recreation program activities; through a series of workshops, students are instructed in leadership skills in such program areas as recreational dance, drama, music, arts and crafts, and social recreation. 1 hour.
 181. **Recreation Program Laboratory, II.** Survey of a number of recreation program activities; through a series of workshops, students are instructed in leadership skills in such program areas as recreational dance, drama, music, arts and crafts, and social recreation. 1 hour.
 182. **Basic Recreation Field Experience.** Directed field experience in public and private recreation agencies; gives students majoring in recreation an introduction to working in actual field situations; students work in University-approved agencies of their own choice four to thirty-two hours each week. Prerequisite: Recreation 100 and 110. 1 or 2 hours. Must be repeated in a different responsibility classification.
 199. **Undergraduate Open Seminar.** 0 to 9 hours.
 200. **Leadership in Recreation and Park Administration.** Introduces the student to the various theories of leadership applicable to situations that exist in the field of recreation and park administration; provides practice in various leadership settings and techniques for the evaluation of leadership performance. Prerequisite: Recreation 100 or 110. 3 hours.
 210. **Theories and Methods of Supervision.** Concepts, principles, and objectives of supervision; the nature of the supervisory relationship; supervisory functions and processes; identification and application of methods and techniques; and organizational and operational patterns of supervision in recreation and park settings. Prerequisite: Recreation 180 and 181, or consent of instructor. 3 hours.
 215. **Recreation Program Development.** Theory and practice in recreation program development in the various recreation settings, including public, private, and commercial operations; core programming and programming dictated by the needs of the field, setting, or clientele; and program evaluation. Prerequisite: Recreation 100 and 200, or consent of instructor. 3 hours.
 250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, or related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 to 3 hours. May be repeated for a maximum of 4 or 6 hours.
 260. **Honors Seminar.** Same as Health Education 260 and Physical Education 290. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a maximum of 6 hours.
 272. **Organization of Aquatic Programs.** Same as Physical Education 272. History of aquatic

ics; leadership training methods; swimming pool sanitation; pool and beach control; and operational records. 2 hours.

273. **Recreation in Rural Areas.** Same as Agricultural Economics 273. Growth and development of recreation in rural areas; leadership development; agencies; and types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, \$5.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours.
274. **Urban Recreation.** Orientation to the urban and inner-city setting and to the role of recreation within this community; methods and techniques effective in out-reach programs; guest lecturers in related fields such as urban planning, social work, etc.; guest speakers from local community; field trips and field experience; and readings from several disciplines as relevant. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.
280. **Professional Seminar.** Seminar discussions to prepare students for supervisory internship; placement; agency-university relationships; evaluation; resume writing; and professional code of ethics. Prerequisite: Recreation 182; junior standing; consent of the coordinator of field work programs. 1 hour.
282. **Field Practicum, I.** Students are assigned to approved field instruction agencies in a supervisory capacity for a minimum of forty hours per week for an eight-week session; both the agency and the University provide supervision. Prerequisite: Recreation 280. 4 to 8 hours. May be repeated to a maximum of 8 hours.
283. **Field Practicum, II.** Students are assigned to approved field instruction agencies in a supervisory capacity for a minimum of forty hours per week for an eight-week session; both the agency and the University provide supervision. Prerequisite: Recreation 282. 4 hours.
290. **Research in Recreation and Parks.** The place of research in recreation and parks; research design; data collection, processing, and analysis; use of completed research; and development of an appreciation of and an ability to evaluate and utilize research rather than an ability to conduct research. Prerequisite: Senior standing; consent of instructor. 3 hours.
299. **Off-Campus Study.** Provides campus credit for foreign or domestic study completed off-campus. A student's proposal for study must have prior approval of the major department and the college office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Advanced standing and approval of major department and college. 0 to 16 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 32 hours.
310. **Introduction to Administration.** Organization of public and private agency programs, leadership, facilities, and services; introduction to recreation administration. Prerequisite: Recreation 100; advanced undergraduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
315. **Play Theories and Their Implications.** Classical and modern theories of play; critical analysis of definitions, concepts, and assumptions and of extant research and research strategies; implications for programming and planning for play. Prerequisite: Recreation 110 and 215; junior standing; or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
320. **Park Management.** An intensive study of the principles, practices, and problems involved in managing public park systems; designed to provide a professional background including the history of parks, organization, planning, examination of facility design and layout, maintenance, finance, and operation of park systems. Prerequisite: Senior standing in recreation, or consent of the instructor; credit in the following courses or equivalent: Landscape Architecture 226; Urban Planning 171; Political Science 305; Recreation 280 and 281. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Recreational Use of Public Lands.** Study of lands in the public domain and their historical, current, and potential use for outdoor recreation; an analysis of land, woods, and water in the public domain; the demand for outdoor recreation; multiple-use concept of natural resources; functions and policies of federal and state governments and their agencies; the economics of outdoor recreation; and the future of outdoor recreation.

tion in America. Prerequisite: Recreation 100; Economics 108; Geography 214; or consent of instructor. 3 hours, or ½ or 1 unit.

330. **Principles of Therapeutic Recreation.** Concepts, principles, objectives, methods, and settings of recreation for the ill and handicapped. Prerequisite: Advanced undergraduate or graduate standing; Recreation 100, and 180 or 181, or consent of instructor. 3 hours, or ½ or 1 unit.
331. **Recreation Leadership for Special Groups.** Leadership theory and methods applied, in recreational settings, primarily to groups of the mentally ill, the mentally retarded, the physically disabled, and those with conduct disorders. Prerequisite: Recreation 110 and 130. 3 hours, or ½ to 1 unit.
343. **Social Psychology and Motor Behavior.** Same as Physical Education 343. The use of social psychological theory and methods in the study of motor behavior; emphasis given to the influence of social psychological processes on motor skill acquisition, including such variables as social facilitation, competition, aggression, attitudes, and personality. Prerequisite: Educational Psychology 390 or Psychology 201, or consent of instructor. 4 hours or 1 unit.
348. **Social Problems Related to Physical Activity and Sport.** Same as Physical Education 348. A seminar with field study on physical activity and sport for marginal, deviant, or sociopsychologically deprived groups. Prerequisite: Six hours in the social sciences or consent of instructor. 2 hours, or ½ or 1 unit.
349. **Analysis of Small Groups in Play and Sport.** Same as Physical Education 349. The methodology of small group research and analysis of the small group in play and sport; discussion of culture, social structure, and personality structure in the group; and class and student observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or ½ or 1 unit.
381. **Management Internship.** Work-study experience in the management aspects of leisure service delivery systems. Students are assigned to agencies in their special fields of study and are closely supervised by University faculty. Prerequisite: Recreation 282 and 283, or graduate standing. 2 to 4 hours, or ½ to 1 unit.
401. **Foundations of Recreation.** Basic philosophical, historical, and scientific foundations and developments in leisure and recreation; analysis of recreation values as related to other contemporary individual and community needs; and functions and settings of organized recreation, special problem areas, and current issues. Prerequisite: Recreation 100 or equivalent. 1 unit.
402. **Recreation Administration.** Strengthens the graduate student's knowledge of the public administration of recreation programs and services provided by municipal, county, state, and national departments and agencies as related to the general well-being of individuals, families, and communities. Prerequisite: Basic course in the organization of recreation or equivalent. 1 unit.
403. **Evaluation of Recreation Resources and Programs.** Methods and techniques of determining recreational needs, interests, and opportunities of individuals and communities through surveys, studies, and appraisals; evaluation and appraisal of community recreation programs and services; and research in the field of recreation. Prerequisite: Recreation 100 or 310, or equivalent; a course in tests or measurement statistics. 1 unit.
404. **Outdoor Education and Recreation.** Philosophy, essential principles, methods, techniques, resources, administrative and program practices for outdoor education and recreation. Prerequisite: Recreation 140 or equivalent; one undergraduate course in any one of the following: biology, botany, geology, or zoology. 1 unit.
443. **Group Dynamics in Sport.** Same as Physical Education 443. Presentation of theories and methods in the study of the psychology of small group behavior in sport; an analysis of the literature pertaining to group processes, with particular emphasis on group performance in sport. Prerequisite: Recreation 343 or consent of instructor. 1 unit.
490. **Seminar.** Student presentation of thesis studies, informal discussions, and critical analysis of problems; informal lectures by invited speakers. 0 credit.

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493. **Special Projects.** Independent research on special projects. Open only to students majoring in recreation. Prerequisite: Recreation 403 or equivalent. $\frac{1}{2}$ to 2 units.
494. **Special Topics in Recreation.** Lecture courses in topics of current interest; specific subject matter will be announced in the Timetable. Prerequisite: Will be determined for each course offered and will be indicated in the Timetable. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Preparation of thesis in recreation. 0 to 4 units.

RELIGIOUS STUDIES

Director of Program: Professor W. R. Schoedel

Office: 4016c Foreign Languages Building, Urbana

100. **Patterns in the Religions of Mankind.** Study of elementary religious forms, turning points in the history of religions, and problems of religion and society. 3 hours.
108. **Introduction to Biblical Hebrew.** Same as Hebrew 110. Stress on mastery of grammar, reading, writing, and simple prose composition; reading of simple Biblical prose. 4 hours.
109. **Introduction to Biblical Hebrew.** Same as Hebrew 111. Syntax and reading of simple classics' prose narrative. Prerequisite: Hebrew 110. 4 hours.
110. **World Religions.** Same as Philosophy 110. Survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. 3 hours.
111. **Elementary Koine Greek.** Same as Greek 111. No credit toward graduation is given for Religious Studies 111 without Religious Studies 112. 4 hours.
112. **Elementary Koine Greek.** Same as Greek 112. Continuation of Greek 111 or Religious Studies 111; grammar and reading. Prerequisite: Religious Studies 111 or equivalent. 4 hours.
120. **Judaism: An Introduction.** Conceptions of the Holy Man and of Holiness within the Judaic tradition: the man of God, the worldly scribe, and the philosopher-king; holiness within and outside society; holiness through the heart, the mind, and the law; holiness through study; and the holy land, the holy tradition, and the new holy man. 3 hours.
200. **Intermediate Koine Greek.** Same as Greek 200. Prerequisite: Religious Studies 112 or equivalent. 4 hours.
201. **Ancient Israel: History and Literature.** Same as Humanities 201. The major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion; the function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours.
202. **Earliest Christianity: The New Testament Period.** Same as Humanities 202. The ministry and teaching of Jesus within the historical context of ancient Judaism; the development of the Christian church from its beginnings as a sect within ancient Judaism to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours.
204. **Prophecy in Israel and the Ancient Near East.** Prophetic performance in the ancient Near East; Israelite prophetic traditions; and general theories about prophecy. 3 hours.
206. **The Parables of Jesus.** The parables in the teaching of Jesus, early Christianity, and the New Testament as expressions of Judaeo-Christian cultural, social, and religious life. Prerequisite: Religious Studies 202. 3 hours.
208. **The Dead Sea Scrolls.** Same as Humanities 208. The literary works discovered in 1947 which were collected or written by a sect within Judaism near Wadi Qumran prior to

the destruction of the Temple of Solomon in the first century of our era; their significance for understanding Judaism and Christianity. Prerequisite: Religious Studies 201 or 202. 3 hours.

210. **Biblical Prose.** Same as Hebrew 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Religious Studies 108 and 109. 4 hours.
211. **Biblical Poetry.** Same as Hebrew 211. Reading and discussion of the Book of Amos and of selections from the Psalms; exercises in prose composition. Prerequisite: Religious Studies 210. 4 hours.
213. **Ancient Near Eastern Myth and Religion.** The nature of mythic literature and religious performance in the Sumerian, Assyro-Babylonian, Hittite, Egyptian, and Canaanite cultures. 3 hours.
220. **Judaism in Modern Europe.** European Judaism from 1648 to 1917: Sabbatism, Hasidism, Zionism, birth of Jewish studies, birth of Reform Judaism, Neo-Orthodoxy, anti-Semitism, birth of modern Hebrew literature, and Secularism. 3 hours.
221. **American Judaism.** Forms of Judaism in America: Reform, Conservative, Reconstructionist, Orthodox, and Hasidic Judaism; the American rabbi; Zionism in American Jewish communal life; national Jewish organizations; the American synagogue; and the secular Jew. 3 hours.
229. **Sociology of Religion.** Same as Sociology 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; and adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Philosophy 230. A critical study of theories about the nature of religion. 3 hours.
231. **Types of Protestant Thought.** Major types of Protestant thought from the Reformation to the present. Prerequisite: Religious Studies 202. 3 hours.
240. **Judaism in Antiquity: From Ezra to Destruction of the Second Temple.** Judaism from 586 B.C. to A.D. 70: Nehemiah; the Samaritans; Jewish Apocalyptic; Ben Sira; Philo; the Pharisees; the Dead Sea Sect; the Zealots; the Sicarii; the Sadducees; and Judaism and Hellenism. 3 hours.
241. **Judaism in Antiquity: The Rabbinic Period.** Judaism from the destruction of the Second Temple until the Moslem conquest; the religion of the ordinary folk; the synagogue; the literary products of the period; the social forms of rabbinic Judaism; and the theology of the rabbis. 3 hours.
250. **Advanced Old Testament Topics.** Advanced study of Old Testament literature and history with special attention to the critical methodologies of Biblical research. Course participants will aid with instruction of Religious Studies 201. Prerequisite: Religious Studies 201 and invitation of instructor. 3 hours.
290. **Independent Study.** Special topics not treated in regularly scheduled courses; designed primarily for upperclassmen. Prerequisite: Evidence of adequate preparation for such study; consent of staff member supervising the work. 2 to 6 hours. May be repeated.
293. **Topics in Biblical Interpretation.** Detailed interpretation of selected books of the Bible. Prerequisite: Religious Studies 201 or 202. 3 hours.
297. **Introduction to Hinduism.** Elements of Hindu thought and practice; selected topics presented in historical order and in the context of Indian cultural history (including the present). 3 hours.
304. **Medieval Civilization.** Same as History 304. Religious and intellectual. Prerequisite: One year of college history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
305. **The Age of the Renaissance.** Same as History 305. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **The Age of the Protestant and Catholic Reformation, 1500-1648.** Same as History 306. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as History 307. The Near

East under the Arab caliphs; the political, institutional, and intellectual development of Islam. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.

320. **Tannaic Legal Texts.** Readings in Hebrew from Tannaic legal texts; Mishnah-Tosefta. Prerequisite: Hebrew 211 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
328. **Sociology of Asian Religions.** Same as Sociology 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa; focus on the problems of social change and development; and concentration on the religious and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Religious Studies 229 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **Martin Luther.** Same as German 330. Special attention to Luther as an artist and to his importance for the development of German language and literature; attention also paid to the historical and intellectual trends of the fifteenth and sixteenth centuries as well as to the significance of Luther in modern psychological and sociological thought. Prerequisite: A reading knowledge of German or Latin, or consent of the instructor. 3 hours or $\frac{3}{4}$ unit.
340. **The Formation of Christian Thought.** Study of major developments in early Christian thought (first four centuries) through discussion of primary texts in translation. Prerequisite: Religious Studies 201 and 202, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
350. **Problems in Religious Thought: History, Historicity, and Belief.** Analysis of the New Testament gospel narratives; selected apocryphal gospels; debates over the historical integrity of gospel materials; production of lives of Jesus; the effort to delineate the mythological dimensions of the gospel narratives; and contemporary attempts to correlate thought. Prerequisite: One course in religious studies or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
360. **Patristic Latin.** Same as Latin 360. Literary and historical texts in prose and poetry from Tertullian to Jerome and Augustine. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
362. **Philosophy of Religion.** Same as Philosophy 324. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their modern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Religion in Anthropological Perspective.** Same as Anthropology 363. Introduction to the study of magical and religious beliefs and practices in tribal and peasant societies; consideration of theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socioreligious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
368. **Indian Philosophy.** Same as Philosophy 369. Survey of Indian philosophy emphasizing readings in the fundamental texts of Indian thought, and developing basic familiarity with the wide range of Indian philosophies and theologies. Prerequisite: Either a previous course in philosophy, or Religious Studies 297, or any of History 387, 393, 397, 398, or 399. 3 hours, or $\frac{3}{4}$ or 1 unit.
369. **Contemporary Religious Thought.** Same as Philosophy 363. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "Neorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
371. **The Gospels.** Same as Greek 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
381. **American Thought and Culture, I.** Same as History 371. The impact of fundamental ideas in shaping American culture, character, and institutions from the colonial beginnings to the mid-nineteenth century; emphasis on Puritanism, the Enlightenment, and romanticism, and on the interplay between religious, scientific, political, social, educational, and artistic thought in the life of the American people. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

382. **American Thought and Culture, II.** Same as History 372. The impact of fundamental ideas in shaping American culture, character, and institutions from the mid-nineteenth century to the present; emphasis on the role of Darwinism and naturalistic thought; political, cultural, religious, and intellectual forces and their interrelations; the American university; the impact of science and technology; and the emergence of neoromanticism. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
387. **History of Indian Buddhism.** The history of Buddhism in India from the Buddha to the Tantra, with emphasis on religious thought and practices. 3 hours, or $\frac{3}{4}$ or 1 unit.
397. **History and Thought of Japanese Buddhism.** Same as History 397. The Japanese response to Buddhism and its influence on Japanese life and culture. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
399. **History and Thought of Chinese Buddhism.** Same as History 399. The interaction of Buddhism with Chinese thought and institutions from its introduction to the present. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
490. **Independent Study.** Special topics not treated in regularly scheduled courses; for graduates. Prerequisite: Evidence of adequate preparation for such study and consent of staff member supervising the work. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units. May be repeated.

RHETORIC AND COMPOSITION

(See English)

ROMANCE LINGUISTICS

(See Spanish, Italian, and Portuguese)

RUMANIAN

(See Spanish, Italian, and Portuguese)

RURAL SOCIOLOGY

(See Agricultural Economics)

RUSSIAN

(See Slavic Languages and Literatures)

RUSSIAN LANGUAGE AND AREA STUDIES

Director of Center: Professor R. T. Fisher Jr.

Center Office: Room 150, 1208 West California Avenue, Urbana

For information regarding Russian language and area studies, please consult the *Undergraduate Programs* catalog.

SAFETY EDUCATION

(See Health and Safety Education)

SANSKRIT

(See Asian Studies)

SCANDINAVIAN

(See Germanic Languages and Literatures)

SECONDARY AND CONTINUING EDUCATION

Chairman of Department: Professor I. D. Westbury

Department Office: 395 Education Building, Urbana

101. **Introduction to the Teaching of Secondary School Subjects.** An analysis of problems and trends in the teaching of high school subjects; special sections provided in the usual high school fields; standard and new programs assessed; and research and empirical evidence explored as they relate to effective teaching of the special subjects. 2 hours.
106. **Introduction to Computers for Teachers.** Same as Computer Science 106. Introduction to the principles of computer operation and programming, and their applications to education. Students use computers to solve problems. Credit may be received for only one of the following: Computer Science 101, 103, 105, 106, 107, or 121. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
240. **Principles of Secondary Education.** Provides each specialized educational worker with a common orientation to the major responsibilities of the public school as a unit and to his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Secondary Education 101; Psychology 100. 2 hours.
241. **Technic of Teaching in the Secondary School.** Methods of teaching specific subject matter fields in the secondary school; special sections provided in the usual high school subjects. Prerequisite: History and Philosophy of Education 201; Secondary Education 240; concurrent registration in Educational Practice 242; consent of instructor. This course meets only during the first eight weeks of the semester. 3 to 5 hours.
247. **Teaching of Speech.** Same as Speech Communication 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.

249. **Independent Study.** Permits study of problems not considered in other courses; for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours. (Section B, 3 hours).
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
336. **Fundamentals of Reading Techniques.** Same as Elementary Education 336. Basic principles, techniques, and materials for the developmental reading program; emphasis on methods and materials that provide for differentiated instruction. Prerequisite: Junior standing; concurrent registration in a teacher education curriculum. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Elementary Education 338. Developmental reading programs beyond the primary grades; factors related to reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Secondary Education 336, or Educational Psychology 211; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Audio-Visual Communication.** Same as Elementary Education 354 and Library Science 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **The Computer and Mathematics Education.** Surveys the role of the computer as an educational tool with an emphasis on applications for teaching precollege mathematics; analysis of computational problems and development of algorithms for their solution; iteration, nonlinear interpolation, and Monte Carlo methods; computer-assisted instruction; individually prescribed instruction; modular scheduling; information retrieval; library programs; and natural language analysis. Prerequisite: Computer Science 101 or 400, or consent of instructor. 4 hours or 1 unit.
357. **Computer-Assisted Instruction.** Same as Computer Science 357. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons; treatment of topics including instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Any Computer Science 100-level programming course, or consent of instructor. 4 hours or 1 unit.
439. **Fundamentals of Curriculum Development.** Explores and clarifies the several theoretical bases offered in educational literature for each of the major aspects of curriculum planning; indicates the forms implementation of these theories have assumed in practice; reduces these theoretical and practical differences to fundamental issues; encourages critical evaluation of both the theories and practices from the standpoint of logical and empirical evidence; and projects, on the basis of such analysis, needed research, present best practice, and ultimately desirable programs. 1 unit.
441. **Linguistic and Logical Analysis of Teaching.** An analysis of teaching from the standpoint of semantic and logical factors; discussion of topics such as theories of meaning, definition, explanation, and justification as employed by a teacher. 1 unit.
448. **Continuing Education.** Same as Vocational and Technical Education 448. Development, status, and prospects of continuing education for adults; institutions, agencies, and programs; public policy and policy making for continuing education; organization, administration, finance, and promotion; recruiting, training, and supervising staff; planning programs and courses; and the literature of continuing education. Systematic study of individual problems supplements class work. $\frac{1}{2}$ to 1 unit.

- 449. Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the dean of the College of Education.
- 456. Problems and Trends in Specialized Fields of Secondary Education.** Introduces the student to significant problems, points of view, and trends in the field concerned; explores significant research relating to organization, content, and techniques in the field in question. Students are encouraged to make special studies in approved areas. Sections are usually offered in the following fields: (a) language and composition, (b) literature, (c) foreign languages, (d) mathematics, (e) science, (f) social science, (g) physical education, and (h) music. 1 unit.
- 459. Workshop in Curriculum Development.** Curriculum development projects in specialized fields of secondary and continuing education. $\frac{1}{2}$ to 2 units.
- 483. Seminar in Literary Criticism and the Teaching of English.** Same as English 483 and Elementary Education 483. Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
- 490. Seminar for Advanced Students of Education.** Open only to persons who have been admitted for doctoral study in secondary education; sections usually offered in the following fields: (a) English, (b) foreign languages, (c) mathematics, (d) science, (e) social studies, and (f) music. 0 to 1 unit. May be repeated for a maximum of 2 units.
- 491. Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student presents his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
- 499. Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

SERBO-CROATIAN

(See Slavic Languages and Literatures)

SLAVIC LANGUAGES AND LITERATURES

(Including Czech, Polish, Russian, Serbo-Croatian, Slavic, and Ukrainian)

Head of Department: Professor C. L. Dawson

Department Office: 3092 Foreign Languages Building, Urbana

Czech

- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 383. The Structure of Modern Czech.** Analysis of the sound system and grammar of the contemporary Czech language with some reference to its historical development. Prerequisite: A knowledge of another Slavic language, preferably Russian, or consent of department. 3 hours or $\frac{3}{4}$ unit.

384. **Readings in Czech Literature.** Representative works of modern Czech literature and their historical and cultural background. Prerequisite: Czech 383 or consent of department. 3 hours or $\frac{3}{4}$ unit.

Polish

199. **Undergraduate Open Seminar.** 0 to 9 hours.
345. **Polish Literature in Translation, I.** A critical survey, in translation, of Polish literature from the Middle Ages to the end of the nineteenth century illustrating the continuity of certain trends of thought and genre; special attention given to the works in their cultural context. 3 hours or 1 unit.
346. **Polish Literature in Translation, II.** A critical study, in translation, of modern Polish fiction, drama, poetry and essay, from young Poland to the "New Wave;" their contribution to literary styles and genres in Poland and abroad; and special emphasis on Wyspianski, Witkiewicz, and Gombrowicz. 3 hours or 1 unit.
385. **The Structure of Modern Polish.** Analysis of the sound system and grammar of the contemporary Polish language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or $\frac{3}{4}$ unit.
386. **Readings in Polish Literature.** Analysis of selected literary texts. Prerequisite: Polish 385 or consent of department. 3 hours or $\frac{3}{4}$ unit.

Russian

Courses taught in Russian are 211, 212, 213, 214, 215, 216, 217, 301, 302, 303, 304, 313, 314, 422, and 424.

101. **First-Year Russian.** Oral-aural practice and elements of grammar, reading, and writing. For students who have no credit in Russian. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **First-Year Russian.** Continuation of Russian 101. Oral-aural practice and elements of grammar, reading, and writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 101. 4 hours.
103. **Second-Year Russian.** Oral-aural practice, systematic functional grammar, reading, and writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 102 or equivalent. 4 hours.
104. **Grammar Review and Conversation.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures, drills, and homework sheets; special attention paid to improving listening and speaking skills through class discussions and oral reports in Russian. Prerequisite: Russian 103. 4 hours.
105. **Grammar Review and Readings on Russian Culture.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures, drills, and homework sheets, as well as readings on various topics aimed at increasing the student's vocabulary and broadening his cultural awareness of the Russian people. Prerequisite: Russian 103. 4 hours.
106. **Grammar Review and Readings in Russian Literature.** Identical to Russian 105, except that the readings are selected from Russian artistic literature. Prerequisite: Russian 103. 4 hours.
111. **Intensive First-Year Russian.** Oral-aural practice and elements of grammar, reading, and writing. Equivalent to Russian 101 and 102; for students who have no credit in Russian. All students in this course are required to register for two hours of work weekly in the language laboratory. 8 hours.

114. **Russian Civilization.** Same as Humanities 114. Survey of Russian civilization and culture with special emphasis on areas other than literature: the people, national and social institutions, religion, and the arts (architecture, sculpture, painting, music, theatre, ballet). No knowledge of Russian required. 4 hours.
115. **Russian Literature in Translation, I.** Critical survey of major works in Russian literature from the Kievan period to the early Tolstoy, with emphasis on the first half of the nineteenth century; in English translation. 3 hours.
116. **Russian Literature in Translation, II.** Critical survey of major works in Russian literature from the middle years of the nineteenth century to the Revolution, with emphasis upon Dostoevsky, the mature Tolstoy, Chekhov, and others; in English translation. 3 hours.
121. **Beginning Reading Course, I.** Russian basic grammar and vocabulary for recognition purposes; prepares students to read Russian for meaning and to translate into English. This course, taken in sequence with Russian 122, 123, and 124, meets the same requirements and can be taken in place of Russian 101, 102, 103, and 104. 4 hours.
122. **Beginning Reading Course, II.** Practice in reading and translating Russian texts of a general and specialized nature; emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 121. 4 hours.
123. **Intermediate Reading Course, I.** Practice in reading and translating Russian texts of a general and specialized nature; emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 122. 4 hours.
124. **Intermediate Reading Course, II.** Continuation of Russian 123. Prerequisite: Russian 123. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
211. **Oral Russian, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 104 or consent of instructor. 3 hours.
212. **Oral Russian, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 211 or consent of instructor. 3 hours.
213. **Russian Composition, I.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 104 or consent of instructor. 3 hours.
214. **Russian Composition, II.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 213 or consent of instructor. 3 hours.
215. **Introduction to Russian Literature, I.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Two years of college Russian or consent of instructor. 3 hours.
216. **Introduction to Russian Literature, II.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Russian 215 or consent of instructor. 3 hours.
217. **Introduction to Contemporary Russian Literature.** Reading and critical analysis of selected readings from post-thaw (1956) Russian literature. Prerequisite: Russian 215. 3 hours.
280. **Teachers Course.** An introduction to the problems of the teaching of Russian and a study of textbooks. Prerequisite: Three years of college Russian or equivalent. 4 hours.
291. **Senior Thesis and Honors.** Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours.
292. **Senior Thesis and Honors.** Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours.
301. **Russian Prose Fiction, I.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature; emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 216 or equivalent. 3 hours or $\frac{3}{4}$ unit.
302. **Russian Prose Fiction, II.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature; emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 301. 3 hours or $\frac{3}{4}$ unit.

303. **Advanced Reading and Conversation, I.** Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Three years of college-level Russian. 3 hours or ½ unit.
304. **Advanced Reading and Conversation, II.** Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Russian 303 or equivalent. 3 hours or ½ unit.
307. **Structure of Russian.** The morphology, syntax, and lexicon of modern Russian contrasted with English; attention to problems of teaching. Prerequisite: Russian 214 or consent of instructor. 3 hours or ¾ unit.
308. **Russian Phonetics and Pronunciation.** Study of the Russian sound system; training in the improvement of pronunciation and intonation. Prerequisite: Russian 212 or consent of instructor. 3 hours or ¾ unit.
313. **Advanced Composition and Usage, I.** Practice in advanced composition and study of advanced problems of grammatical structure; emphasis on morphological categories in Russian grammar. Prerequisite: Three years of college Russian including Russian 214, or consent of instructor. 3 hours or ¾ unit.
314. **Advanced Composition and Usage, II.** Further practice in advanced composition and study of advanced problems of grammatical structure; emphasis on syntax, usage, and style. Prerequisite: Russian 313 or consent of department. 3 hours or ¾ unit.
315. **Nineteenth-Century Literature in Translation.** Same as Humanities 315. A study of major Russian writers from Pushkin through Chekhov; no knowledge of Russian required. 3 hours or 1 unit.
317. **Twentieth-Century Literature in Translation.** Same as Humanities 317. A study of major Russian writers from 1900 to the present; no knowledge of Russian required. 3 hours or 1 unit.
321. **Russian Literature from 1810-45.** Representative works of the period, with emphasis on Pushkin, Lermontov, and Gogol. Prerequisite: Russian 301. 3 hours or ¾ unit.
322. **Dostoevsky and Tolstoy.** Representative works in their historical and cultural contexts. Prerequisite: Russian 301. 3 hours or ¾ unit.
323. **Russian Literature from 1845-80.** Representative works of the period, with emphasis on Turgenev and Goncharov. Prerequisite: Russian 301. 3 hours or ¾ unit.
324. **Russian Modernism.** Representative works of the period 1880 to 1917, with emphasis on Chekhov, Gorky, and Blok; readings for nonmajors and class discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or ¾ unit.
325. **Soviet Russian Literature.** Representative works of Russian literature since 1917: Mayakovsky, Leonov, Sholokhov, and others; historical and cultural backgrounds. Prerequisite: Russian 301. 3 hours or ¾ unit.
335. **Russian Drama.** Historical survey of Russian dramatists and their works, from the origins in folk and liturgical playlets through classicism, Gogol, Ostrovsky, Chekhov, and Stanslavsky to Meirhold and the Soviet drama. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.
337. **Russian Poetry.** A study of significant Russian poets and their works from Zhukovsky through the twentieth century. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.
370. **Vladimir Nabokov.** Same as Comparative Literature 370 and English 370. The major contribution of Vladimir Nabokov to world literature; no knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
400. **Beginning Russian for Graduate Students.** Basic grammar and vocabulary; introduction to the reading of Russian texts in the sciences and the humanities. Designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. 0 credit.
401. **Readings in Russian for Graduate Students.** Reading and translation of general and individually specialized materials, to increase speed, accuracy, and vocabulary; designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. Prerequisite: Russian 400 or equivalent. 0 credit.

406. **Russian Morphology.** Survey of the various parts of speech of modern standard literary Russian with special emphasis on the nominal and verbal systems. 1 unit.
407. **Russian Syntax.** Survey of historical and contemporary Russian syntax. Prerequisite: Consent of instructor or head of department. 1 unit.
408. **Russian Phonology.** Same as Linguistics 408. The sound pattern of Russian in its synchronic and diachronic aspects. Prerequisite: Consent of instructor. 1 unit.
410. **Old Russian Literature.** Reading and analysis of texts with historical and literary commentary. Prerequisite: Slavic 405. 1 unit.
412. **Literature of the Eighteenth Century.** Reading of texts; historical and literary background of the period. 1 unit.
414. **Pushkin.** The age of Pushkin; Pushkin's works in historical and comparative perspective; textual criticism, linguistic and structural analysis, intellectual interpretation, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
415. **Dostoevsky.** Same as Comparative Literature 415. Dostoevsky: historical background, textual analysis, structure, philosophy, artistic evaluation, and influence on French, English, American, and German literatures. 1 unit.
416. **Studies in Russian Criticism.** Prerequisite: Consent of instructor or head of department. 1 unit.
417. **History of the Russian Language.** Historical grammar, origin, and development of the literary language. Prerequisite: Slavic 405 or consent of instructor. 1 unit.
419. **Tolstoy.** Same as Comparative Literature 419. Tolstoy: historical background, textual analysis, structure, philosophy, aesthetic evaluation, and influence on French, English, American, and German literatures. 1 unit.
420. **Chekhov.** Same as Comparative Literature 420. Chekhov: historical background, textual criticism, structural analysis, philosophy, artistic evaluation, and interrelationship with English, French, German (and Scandinavian), and American literatures. 1 unit.
421. **Seminar in the Russian Novel.** Dostoevsky, Tolstoy, the nineteenth-century novel, and the twentieth-century novel. Prerequisite: Consent of instructor or head of department. 1 unit. May be repeated for a maximum of 3 units.
422. **Russian Literature in Exile.** Bunin, Merezhkovsky, Kuprin, Zaitsev, Remizov, Tefii, Aldanov, Shmelev, Z. Hippus, V. Ivanov, Khodasevich, Tsvetaeva, Varshavsky, Odoevtseva, G. Ivanov, and Adamovich: prose writers, poets, and critics. 1 unit.
423. **Seminar in Russian Poetry.** Pushkin, narrative verse, lyric verse, and symbolism. Prerequisite: Russian 337 or consent of department. 1 unit. May be repeated for a maximum of 3 units.
424. **Gogol.** Historical background, textual criticism, structural analysis, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
425. **Seminar in Russian Drama.** Intensive analysis and discussion of specific genres, periods, and dramatists in the light of dramatic theories; subject varies each year. Prerequisite: Russian 335 or consent of department. 1 unit. May be repeated for a maximum of 3 units.
463. **College Teaching of Foreign Languages.** Same as French, German, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, German, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Russian 463 or consent of instructor.

Serbo-Croatian

- 199. Undergraduate Open Seminar. 0 to 9 hours.
- 392. **Structure of Modern Serbo-Croatian.** Analysis of the sound system and grammar of the contemporary Serbo-Croatian language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or $\frac{3}{4}$ unit.
- 393. **Reading in Serbo-Croatian Literature.** Reading, analysis, and discussion of selected excerpts from Serbo-Croatian literature, scientific prose, and current press. Prerequisite: Serbo-Croatian 392 or consent of department. 3 hours or $\frac{3}{4}$ unit.

Slavic

- 199. Undergraduate Open Seminar. 0 to 9 hours.
- 319. **Russian and East European Cinema.** Same as Communications, Humanities, and Speech Communication 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or $\frac{3}{4}$ unit.
- 380. **Introduction to Slavic Linguistics.** Same as Linguistics 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or $\frac{3}{4}$ unit.
- 382. **Language Laboratory Techniques.** Same as French, German, and Spanish 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level or equivalent. 2 hours or $\frac{1}{2}$ unit.
- 394. **Introduction to the Methodology of Myth and Folklore.** Same as Comparative Literature 394, English 387, German 394, and Speech Communication 346. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
- 405. **Old Church Slavonic.** Analysis of grammar and reading of texts. Prerequisite: Slavic 380. 1 unit.
- 431. **Comparative Slavic Literature.** Same as Comparative Literature 431. Survey of Slavic literatures, especially Czech, Polish, and Yugoslav, and their connection with Russian and Western traditions. Prerequisite: Reading knowledge of Russian or one other Slavic language, or consent of instructor. 1 unit.
- 460. **Comparative Slavic Linguistics.** A comparative analysis of the structure of contemporary Slavic languages in the light of their common Slavic origin. Prerequisite: Slavic 380. 1 unit.
- 485. **The Structure of West Slavic Languages.** Linguistic survey of the West Slavic languages: Polish, Czech, Slovak, Lusatian, and Kashubian; focus on one of the major West Slavic languages (Czech or Polish) as compared with the other West Slavic languages and languages of the East and South groups. Prerequisite: Slavic 380. 1 unit.
- 491. **Individual Topics.** Prerequisite: Graduate standing with a major or minor in Russian. $\frac{1}{4}$ to 2 units.
- 492. **The Structure of South Slavic Languages.** Linguistic survey of the South Slavic languages: Serbo-Croatian, Bulgarian, Slovenian, and Macedonian; focus on Serbo-Croatian as compared with the other South Slavic languages and the languages of the East and West Slavic groups. Prerequisite: Slavic 380. 1 unit.
- 499. **Thesis Research.** 0 to 4 units.

Ukrainian

199. **Undergraduate Open Seminar.** 0 to 9 hours.
396. **The Structure of Ukrainian.** Ukrainian phonology, morphology, and syntax, presented against Russian as a background and basis for comparison of these two East Slavic languages. Prerequisite: Russian 104 or equivalent. 3 hours or $\frac{3}{4}$ unit.
398. **Readings in Ukrainian Literature.** Representative works of Ukrainian literature and their historical and cultural background. Prerequisite: Ukrainian 396 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

SOCIAL WORK

Director of School: Professor M. P. Hale

School Office: 1207 West Oregon Street, Urbana

100. **Contemporary Social Work.** An overview of social work for potential users of services; policy issues of concern to the citizen-taxpayer-contributor; and career opportunities in the field. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
290. **Honors Seminar.** A series of lectures, student presentations, and discussions on selected topics in social welfare. Prerequisite: Completion of 12 hours in social welfare courses; senior standing; 4.0 grade-point average in courses included in social welfare; and consent of instructor. 2 to 4 hours. May be repeated to a maximum of 4 hours.
298. **Practice Seminar.** Critical examination of the application of knowledge to social work practice; emphasis on reciprocal relationships between personal problems and needs, social environment, agency services, and helping methods; and consideration of new trends in practice and empirical knowledge. Prerequisite: Social work major; consent of undergraduate field instruction coordinator; concurrent registration in Social Work 299. 3 hours.
299. **Field Instruction.** The student is assigned to field instructors for learning experiences in social agencies and communities; experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele and communities. Prerequisite: Social work major; consent of undergraduate field instruction coordinator. 6 to 12 hours.
300. **Methods of Social Work Intervention.** Examination of the methods of social work intervention (casework, group work, and community organization) utilized in various social work agencies and social welfare settings; emphasis on understanding of the values, knowledge, principles, and processes of social work practice. Prerequisite: Credit or concurrent registration in Social Work 310 or Social Work 311. 3 hours, or $\frac{1}{2}$ to 1 unit.
310. **Social Welfare Policy and Services, I.** Critical study of the income maintenance system in the United States as a response to the problems of inequality of opportunity and income, poverty, and income security; consideration of alternative approaches with discussion of the social worker's role in the system. Prerequisite: Admission to social welfare major or minor, or graduate standing. 3 hours or 1 unit.
311. **Social Welfare Policy and Services, II.** Critical evaluation of social policy and services in selected problem areas with attention given to the process of social policy analysis and to strategies for intervention to achieve redirection in use of resources to deal more effectively with the problems. Prerequisite: Credit or concurrent registration in Social Work 310. 3 hours or 1 unit.
316. **Social Services for Children.** Child welfare practice in relation to the state's responsibility for guardianship, the juvenile court, employment, and regulation of child care facilities; an examination of services which support, supplement, or substitute for parental care of children; and consideration of trends and issues in child welfare planning.

Prerequisite: Credit or concurrent registration in Social Work 300, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

318. **Special Problems.** A small group seminar for independent study of a topic or topics of special interest to the field of social welfare; emphasis on examination and discussion of significant and current social welfare issues and problems. Prerequisite: Credit or concurrent registration in Social Work 300; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
326. **Afro-American Life and Culture.** An examination and review of selected aspects of Afro-American life and culture; African heritage, American experience, concept of negritude, and their implications for social workers. Prerequisite: Admission to social welfare major or graduate standing. 3 hours or 1 unit.
327. **Research Methods in Social Work Practice.** Objectives of research pertaining to social work practice; design of experiments; measurement and methods of collecting data; design of questionnaires and schedules; methods of data analysis including statistical hypothesis testing and applications of inferential techniques; interpretation of results; and preparation of reports. Prerequisite: An introductory course in statistics and admission to social welfare major, or graduate standing. 3 hours or 1 unit.
333. **Introduction to Social Group Work.** Background information regarding the development of social group work; attention to the utilization of the group work method in contemporary social work practice, practice principles, and group therapy; and presentation of material through lecture-discussion and by participation in small groups formed from the class membership. Prerequisite: Junior standing with introductory courses in sociology, psychology, and the social sciences. 3 hours or 1 unit.
351. **Human Growth and Behavior, I.** The major forces influencing the growth and behavior of the individual from birth through adulthood; sociocultural, familial, physical, emotional, and intellectual factors as they enhance or retard social functioning; the nature and dynamics of social process as related to growth and behavior; and the relevance of this content to social work practice. Prerequisite: Six hours or psychology and/or sociology; admission to social welfare major or graduate standing. 3 hours or 1 unit.
420. **Comparative Approaches in Community Organization Practice.** Concepts and theories, principles and methods characterizing identifiable approaches used in community organization practice at neighborhood, community, state, and other levels. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
422. **A Comparative Analysis of Approaches in Casework.** A systematic and critical examination of selected approaches (psychosocial therapy, crisis intervention, family treatment, advocacy, behavior therapy, and others), their conceptualizations, procedures, and techniques in casework theory and practice; the employment of a framework for the analysis and assessment for the various approaches; study of research related to process and outcome; and identification of practice issues. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
423. **Comparative Approaches to Social Group Work Practice.** Study of practice theory in social group work through a comparative study of various identifiable practice approaches. Prerequisite: Social Work 425 or consent of instructor. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
425. **Group Process and Method.** Small group theory and the group process; the use of group process and methods in social work practice. $\frac{1}{2}$ to 1 unit.
426. **Social Planning and Administration.** Principles, concepts, and methods of planning and administration of social services; emphasis on leadership, policy and decision making, and program organization. $\frac{1}{2}$ to 1 unit.
428. **Seminar and Practicum in Family Therapy.** Critical examination of the principles, issues, and practice of family therapy; application of concepts to observation of actual family therapy conducted by students and/or the instructor; and the process of developing a model for practice. Prerequisite: Social Work 422 or consent of instructor. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
429. **Seminar in Methods of Intervention with Low-Income Families.** Analysis of distinguishing characteristics and social problems of low-income populations; critical review

of issues regarding social-work interventive methods utilized in the past and at present; and emphasis on analysis, construction, and evaluation of significant practice principles with a view toward innovation. Prerequisite: Social Work 300 or equivalent. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.

431. **Practice Seminar, I.** Critical examination of the application of knowledge to social work practice; emphasis on reciprocal relationships between personal problems and needs, social environment, agency services, and helping methods; and consideration of new trends in practice and empirical knowledge. Prerequisite: Concurrent registration in Social Work 468 or consent of instructor. 1 unit.
432. **Practice Seminar, II.** Critical examination of the application of knowledge to social work practice; emphasis on relationships between personal problems, social problems, planning processes, and agency purposes and functions; and consideration of trends in social policy and empirical knowledge. Prerequisite: Concurrent registration in Social Work 469 or consent of instructor. 1 unit.
435. **Seminar in Staff Development.** Examination of various types of staff development approaches used in social welfare; analysis of selected problems occurring in planning and carrying out a staff development program; and consideration of issues in program planning and in budgeting for staff development. Prerequisite: Social Work 422; concurrent registration in any one of the following: Social Work 420, 422, 423, or 429. $\frac{1}{2}$ to 1 unit.
452. **Human Growth and Behavior, II.** Interrelationship of physical, emotional, and social aspects of selected diseases and implications for the patient, family, and community; psychopathology, including neuroses, psychoses, character disorders, psychosomatic dysfunction, organic conditions, and mental retardation; and diagnosis and treatment methods, including psychotherapy, somatic and drug therapies, and social work. Prerequisite: Social Work 351 or equivalent. $\frac{1}{4}$ to 1 $\frac{1}{4}$ units.
454. **Afro-American Issues Seminar.** A critical analysis of social, political, and economic issues as they relate to the black community and the response of the community to these issues. 3 hours or 1 unit.
461. **Special Studies in Social Work, I.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
462. **Special Studies in Social Work, II.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
467. **Field Instruction, I.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
468. **Field Instruction, II.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Consent of instructor. 1 to 2 units.
469. **Field Instruction, III.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Social Work 422, 467, and 468. 1 to 2 units.
484. **National Social Welfare Policy, I.** Analysis of the impact of changing economic and political doctrines, of ideological differences and struggle, and of major events such as wars, depressions, urban strife, the civil rights revolution, sustained poverty, and cybernetics on national social policies and the operation of social welfare programs; treatment in an historical and institutional context; and work primarily directed toward the development of ideas to guide determination of social work posture and context. Prerequisite: Social Work 310 or consent of instructor. $\frac{1}{2}$ to 2 units.
485. **National Social Welfare Policy, II.** Emphasis on the case approach within the context of basic political and governmental processes which influence the development, enact-

ment, and application of national policy; analytical study of the background, legislative history, amendments, judicial interpretations, and operation of major national acts comprising our national social welfare policy, or bearing directly on social welfare such as the Social Security Act, the Employment Act, the Civil Rights Acts, and the Economic Opportunity Act. Prerequisite: Social Work 484 or consent of instructor. ½ to 2 units.

491. **Research Seminar.** Seminar for students preparing research projects, either in groups or individually; experience in the application of research methods to current social work problems. Prerequisite: Social Work 327 or equivalent. 0 to 2 units.
492. **Seminar on Models for Directed Change.** Same as Sociology 492 and Urban Planning 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels; construction of models as interpretations of behavioral science theory; extrapolation of hypotheses and of guides to intervention from the models; and readings from several disciplines as relevant. Prerequisite: Consent of instructor. ½ to 1 unit.
493. **Methodological Issues in Social Work Research.** Analysis of issues and problems inherent in selected social research methods; identification of special problems in research on social work practice; methodological problems of proof and verification; levels of generalizability; meaning of data objectivity and reliability in use of judgments; and development of a framework for reformulation of research problems and for selection of research methods. Prerequisite: One course in social research methods. ½ to 1 ½ units.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations 497, Educational Administration 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Research and writing of doctoral thesis. 0 to 5 units.

SOCIOLOGY

Head of Department: Professor B. Karsh

Department Office: 326 Lincoln Hall, Urbana

100. **Introduction to Sociology.** Introductory analysis and description of the structure and dynamics of human society; special emphasis on the application of scientific methods to the observation and analysis of social norms, groups, intergroup relations, social change, social stratification, and institutions. Credit is not given for both Sociology 100 and Rural Sociology 117. 3 hours.
131. **Social Problems.** Introductory survey of sociological aspects of chief modern social problems; stress on the social interrelationships and cultural conflicts involved in their genesis, significance, and amelioration or prevention. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
184. **Nonstatistical Introduction to Social Science Research Methods.** Emphasis on the formulation of social science issues as research questions, the various types of research methods and their advantages and disadvantages, the design of research programs, the analysis and appraisal of research findings, and research reporting; critical examination of major studies in sociology, political science, and anthropology. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.
185. **Introduction to Social Statistics.** Same as Geography 185. A first course in social statistics for students without mathematics beyond the high school level; topics include the

role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.

190. **Individual Topics for Undergraduates.** Individual study and investigation of selected problems in the sociological aspects of behavior. Prerequisite: Six hours of sociology, or 3 hours of sociology and concurrent registration in another sociology course; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.
198. **Freshman Honors Seminar.** Provides intensive exposure to the problems and approaches of sociology as a discipline by means of research, reports, and discussion on a substantial topic in the field. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
201. **Introduction to Social Psychology.** An introduction to the study of relationships between the functioning of social systems and the behavior and attitudes of individuals; special reference to social and cultural factors in personality development and perceptual processes, and to role behavior and small group interaction. Credit is not given for both Sociology 201 and Psychology 201. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.
202. **Sociology of Poverty.** Analysis of institutional structures which tend to maintain poverty in industrialized societies, particularly the United States, in the context of social stratification. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
206. **Political Sociology.** An examination of the social contexts of political behavior, including behavior within formal organizations such as trade unions, the formation and maintenance of elite groups, and the development of movements for political change; focus chiefly on the informal processes that impinge upon and occur within different institutions, illuminating such processes by reference to materials on political behavior in the United States as well as in other nations. 3 hours.
208. **Collective Political Violence.** The study of the causes, processes, and effects of collective violence, particularly of riots, coups, and revolution. Prerequisite: Sociology 100. 3 hours.
212. **Culture Patterns and the Individual.** Relationships between institutional structure and culture patterns and the common drives, attitudes, and other adjustive mechanisms of the group members. Prerequisite: Sociology 100; junior standing. 3 hours.
218. **Technology and Social Change.** The implications of science and technology for social change; effects of innovation upon social relationships in different cultures; theories of social change; the social effects of selected major inventions; and a cross-cultural analysis of the processes of "industrialism." Prerequisite: Sociology 100 or equivalent. 3 hours.
221. **Contemporary Society.** Basic character of modern life forms; underlying principles and efforts at reorientation. Prerequisite: Sociology 100; junior standing. 3 hours.
222. **Introduction to Modern Africa.** Same as African Studies, Anthropology, and Political Science 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in African politics, economics, sociology, anthropology, and history. 3 hours.
223. **Stratification and Social Classes.** Systems of social ranking in human societies, with emphasis on the class structure of the United States; power, prestige, and privilege as related to class differences in the United States and other societies; the culture and styles of life of different classes; class and status as determinants of group interests, ideologies, and interaction; and effects of social change and mobility on class structure. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
224. **Sex Stratification in Industrial Societies.** Analysis of social institutions which perpetuate systematic discrimination by sex in industrial societies, with emphasis on occupations. Prerequisite: Sociology 100 or equivalent. 3 hours.

225. **Racial and Cultural Minorities.** A sociological and social-psychological analysis of minority groups; illustrative material drawn from representative racial, ethnic, and status groups. Prerequisite: Sociology 100; junior standing. 3 hours.
228. **Sociology of Leisure.** Problems surrounding increases in the amount of leisure; leisure as an index of values; leisure and industrialization; the Protestant ethic; the relevance of social organization, culture, stratification, the family, and occupation to the use of leisure; leisure subcultures; problems of mass culture; and the classification of leisure activities. Prerequisite: Three hours of sociology or consent of instructor. 3 hours.
229. **Sociology of Religion.** Same as Religious Studies 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; and adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
231. **Analysis of Juvenile Delinquency.** Conceptions of delinquency and its causations; the juvenile court movement; juvenile detention; treatment of juvenile offenders; and delinquency prevention programs. Prerequisite: Sociology 100. 3 hours.
240. **Collective Behavior.** The study of spontaneous, emergent, or transitory actions by large numbers of people not linked through formal organization and not necessarily by common group identity: the phenomena of crowds, mobs, panics, disasters, rumors, booms, fads and fashions, audiences, masses, publics, propaganda targets, and social movements; implications of this behavior from the standpoints of personal problems and social change. Prerequisite: Sociology 100. 3 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications 251 and Journalism 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
270. **Population and Human Ecology.** Same as Rural Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories of human ecology; and current problems. Prerequisite: Sociology 100 or Rural Sociology 117; junior standing. 3 hours.
275. **Sociology and the Community.** Nature, structure, and functions of the community; types of communities and examples of some better community studies; and the relation of the community to the larger social organizations. Prerequisite: Sociology 100. 3 hours.
276. **Sociology of the City.** Study of urban structure and ecology, particularly in light of the planning movement; urban populations; and growth and development of urban communities. Prerequisite: Sociology 100; junior standing. 3 hours.
277. **Rural Social Change.** Same as Rural Sociology 277. Social forces retarding or accelerating change (traditions, beliefs, attitudes, innovations, social movements, and social planning) as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed \$5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.
290. **Honors Course.** Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.
291. **Honors Course.** Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 1 to 6 hours. May be repeated.
300. **Twentieth-Century Sociological Theory.** Attempts to give some idea of four theoretical approaches: symbolic interactionism, structural-functional theory, conflict theory, and the reductionism of George Homans; treatment at varying length of important theorists including Marx (the only one from the nineteenth century), Weber, Durk-

- heim, Simmel, Mead, and Cooley; and living theorists, besides Homans, including Parsons, Merton, and Dahrendorf. Prerequisite: Sociology 100. 3 hours or 1 unit.
303. **Japanese Society.** Same as Asian Studies 303. The institutions of contemporary Japan and their historical roots; the Japanese approach to modernization and development and social change; and implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
306. **Youth and Politics.** Addresses the issues of how and why young people in America and throughout the world become involved in political activities; examines the nature and style of youth politics; and emphasizes political socialization and historical and cross-national perspectives. Prerequisite: Sociology 206 recommended. 3 hours or $\frac{3}{4}$ unit.
309. **South Asian Social Organization.** An analysis of traditional and emergent features of social organization in South Asia; analyses of family, caste, and village organization; political, economic, and religious change; urbanization; industrialization; and demography. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
311. **Sociology of Intellectual Life.** A comparative sociological analysis of the development of the intelligentsia in Europe and elsewhere; central concerns include the institutional supports for intellectual work under various social and cultural conditions, the social origin and status of different types of intellectuals, the formulation of distinct scientific traditions, and the relationship of these traditions to ideology, literature, and philosophy; and a critical scrutiny of the theoretical literature and methodology of the sociology of knowledge. Prerequisite: Sociology 100, or 8 hours in social science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
315. **Sociology of Education.** Same as History and Philosophy of Education 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on the present education in countries which share Western civilization. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
316. **Sociology of Adolescence.** Adolescence in modern societies; social class, ethnic and minority group membership, and other variables as reflected in adolescent behavior; the problems of adolescence (discontinuities in social development, search for identity, intergenerational conflict, academic and social failure, and juvenile delinquency); the socializing institutions of family, education, peer culture, politics, religion, welfare, social control, the work world, and recreation and leisure; and emphasis on research. Prerequisite: Sociology 100; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **Sociology of Law.** A general treatment of the social origins and consequences of law and legal process; special emphasis on problems of legal change and on the structure and functioning of legal sanctions; and some attention to law and law-like phenomena in other societies including primitive societies, but major focus on American society. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Industry and Society.** Same as Labor and Industrial Relations 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; and the changing bases of managerial authority. Prerequisite: Sociology 100, or 6 hours of social science, or consent of instructor; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
320. **Social Roles.** Contemporary role theory and related concepts such as social status and social interaction; age, sex, vocational, social class, and other role types; applications of this theory to the study of the socialization process and personal adjustment; and the analysis of critical group situations and social change. Prerequisite: Sociology 100; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Family and Kinship.** An analysis of family and kinship, with major concentration on the American family; investigation of implications of the American kinship system for trends in courtship and mate selection, interaction among kin, and other areas of family life. Prerequisite: Sociology 100, or 8 hours of social science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

322. **Sociology of Bureaucracy and Administrative Organization.** An analysis of major types of formal organization from the viewpoint of generalized theories of organization and of substantive theories of bureaucratization and rationalization; study of formal organizations including business enterprises and unions, educational and medical institutions, and nonvoluntary organizations; and particular emphasis on the interrelations between bureaucracy, ideology, and social structure. Prerequisite: Nine hours of sociology including Sociology 300, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
323. **The Small Social Group.** Theory, observation, and analysis of face-to-face social groups, such as friendships, cliques, clubs, committees, and laboratory and experimental groups; characteristics, functions, and forms of interaction of small groups; and recent theoretical and empirical developments in this field of sociology. Prerequisite: Sociology 201 or Psychology 201. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Penology.** Probation, parole, and methods of institutional treatment. Prerequisite: Sociology 331. 3 hours, or $\frac{1}{2}$ or 1 unit.
325. **The Philosophy of Social Science.** Same as Anthropology 329 and Philosophy 329. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
326. **Social Mobility and Class Structure.** An advanced course in social stratification, concerned with patterns, causes, and consequences of social mobility and immobility; the analysis of rising and falling classes in industrial and developing countries and the circulation of political, social, and economic elites as well as institutional sources of individual mobility. Prerequisite: Sociology 223 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
328. **Sociology of Asian Religions.** Same as Religious Studies 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa; focus on the problems of social change and development; and concentration on the religions and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Sociology 229 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **Comparative Family Institutions.** Cross-cultural analysis of family institutions, with special reference to vital and demographic backgrounds; stress on property, authority, and the handling of deviance, and relationship to religion, economy, and polity. Prerequisite: Sociology 185. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **Comparative Political Sociology.** Discussion of basic sociological theories of politics; emphasis on the analysis of forces that keep societies functioning and those that disrupt them and produce political and social change; discussion of social institutions and social movements; and consideration of the relationship between economic development and changes in other aspects of society. Prerequisite: Nine hours of social science or consent of instructor. 3 hours or 1 unit.
331. **Criminology.** Nature and extent of crime; past and present theories of crime causation; criminal behavior in American society and its relation to personal and cultural conditions. Prerequisite: Sociology 100; junior standing; prelegal juniors may be admitted with consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Psychology 332. Lectures and laboratory in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185. 4 hours, or $\frac{1}{2}$ or 1 unit.
335. **Comparative Social Stratification.** Role of social stratification, nature of social class, class determinants of culture, and class dynamics in comparative perspective; case studies of the United States, slave society, European and Japanese feudalism, Russia, India, China, and a nonliterate society. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
340. **Social Movements.** Analysis of the factors in the formation and dynamics of social movements as collective behavior; patterns of growth, types of leaders, and control mechanisms. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.

- 343. Social Change in Developing Areas.** Same as Rural Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies; special attention given to problems of traditional social structure undergoing modernization; and social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, family, and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 350. Soviet Social Institutions.** Analysis of the major social institutions of Soviet society; special attention to the structural consequences of Communist ideology, totalitarianism, and industrialism, and to comparison with and implications for American society; the major areas covered include population data and their sociological implications; history, values, and ideology; political institutions; economic institutions; social stratification and mobility; the nationalities; the family and education; communications and public opinion; and socialized medicine. Prerequisite: Sociology 100 or consent of instructor. Students enrolled in Russian language and area studies as majors or minors are admitted without prerequisite or special permission. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 352. Attitude Theory and Change.** Same as Communications 352 and Psychology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201, or a comparable course of introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 355. Chinese Society.** Systematic treatment of China's social, cultural, and demographic heritage and of the impact of the West on an ancient civilization; the processes of planned and unplanned change in Chinese society; and topics including peasant-land economy, the family, patterns of social stratification and social mobility, the persistence of traditional forms, and the adoption and adaptation of new patterns. Prerequisite: Sociology 100 or Rural Sociology 117, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 359. The Social Psychology of Organization.** Same as Psychology 359. Analysis of the interrelationships between social and psychological factors, and organizational structure and process; emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Sociology 322 or Psychology 355. 3 hours or 1 unit.
- 360. Sociology of the Professions.** Examination of the nature, position, functions, and growing importance of the major professions in the contemporary industrial (or industrializing) society; attention to the relationship between the social system and the various professional "communities," recruitment, professional socialization, and bureaucratic versus independent practice. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 369. Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Veterinary Medical Science, and Zoology 369. Application of principles of animal ecology to human biology; emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, psychology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper, the credit may be 3 or 5 hours.
- 371. Comparative Social Institutions.** Examination, in a comparative perspective, of some of the major institutional complexes of social systems, such as family and kinship structures, occupations, political institutions, and social stratification and mobility; illustrative materials drawn from a variety of societies, including primitive, nonliterate societies and advanced industrial societies such as the United States, Germany, and the Soviet Union. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 373. Latin American Social Organization and Institutions.** Analysis of contemporary institutional and social class structures in Latin American communities and societies, and

their relationship to certain religious and family patterns; the influence of past and present trends in urbanization, ecological organization, and population growth upon Latin American social systems and institutional organization. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Veterinary Medical Science 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Sociology 369. 4 hours or 1 unit.
382. **Development of Sociological Thought.** A historical analysis of selected areas of sociological thought, stressing their existential base as meanings systems; includes the origin of sociology, its relation to social Darwinism, psychoanalysis, the debate over functionalism, and the cultural "relevance" of social theories, generally; and figures including Comte, Spencer, Sumner, Ward, Freud, Durkheim, Weber, etc. Prerequisite: Sociology 100, or 8 hours of social science, or consent of instructor. 3 hours or 1 unit.
385. **Social Statistics, I.** Deals intensively with descriptive statistics, probability, statistical inference, and significance testing by means of both parametric and nonparametric tests, and the various measures of association. Prerequisite: Sociology 185, or Mathematics 122 or 123, or consent of instructor. 3 hours or 1 unit.
386. **Methods of Field Research.** Instruction, training, and supervised practice in methods of field research as a basic tool of sociology; emphasis on the role of the field researcher as participant, observer, and interviewer in various kinds of research settings, and on approaches to and applications of field data. Each student develops and executes a field research project dealing with some aspect of institutional, occupational, or general community activity and structure. Prerequisite: Sociology 184 and 185. 3 hours, or $\frac{1}{2}$ or 1 unit.
387. **Social Statistics, II.** Treats analysis of variance, analysis of covariance, multiple and partial correlations, and complicated sampling procedures. A semester problem is developed which emphasizes integration and application of various statistical techniques to sociological problems. Prerequisite: Sociology 385. 3 hours, or $\frac{3}{4}$ or 1 unit.
400. **General Sociology.** Systematic sociology, with emphasis on the development and problems of modern structural-functional theory; analysis of the works of major contributors to functionalism, e.g., Durkheim, Weber, Merton, and Parsons; and an examination of the ways in which their work converges to form a cumulative body of sociological theory. 1 unit.
402. **Social Stratification.** Theory and data concerning structured social inequality in industrialized societies, with special focus on the United States. 1 unit.
405. **European Sociology: Recent Developments.** Analyses of recent developments and original contributions of European sociology; a review of the major sociological centers in France, Germany, Great Britain, Poland, Russia, and Scandinavia; and an emphasis on special problems selected on the basis of their theoretical importance. Prerequisite: Sociology 300. 1 unit.
406. **Recent Developments in Sociological Theory in the United States.** Emphasis on American theorists other than Talcott Parsons; the specific theorists treated vary somewhat from year to year. Prerequisite: Sociology 300. 1 unit.
407. **Population Studies and Demographic Analysis.** Same as Rural Sociology 407. Nature and development of population theories; population growth and measures of fertility, reproduction, mortality, morbidity, and internal migration; indices, rates, and standardizations used in analyzing compositional characteristics; methods in population projections; and relationship of economic, sociological, and psychological factors to population changes. Prerequisite: Twelve hours of social science and introductory statistics or major in sociology, or consent of instructor. 1 unit.
408. **The Sociology of Human Fertility.** Comparative studies of levels of fertility in different societies and in the same societies at different times; analysis of sociological, psychological, and demographic factors affecting human reproduction and family planning, and

consequences of differentials in fertility. Prerequisite: Graduate standing or consent of instructor. 1 unit.

409. **Psychological Scaling.** Same as Psychology 409. Scaling theory and methodology, with emphasis upon measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit. Offered in 1974-75 and alternate years.
410. **Crowd Behavior.** An examination of classic and contemporary theory and research bearing on crowd formation, form, relocation, and dispersal; the production, maintenance, and alteration of various behaviors within crowds; and emphasis on direct observation of, and the design of field and laboratory research bearing on these phenomena. Prerequisite: Sociology 386. 1 unit.
411. **Sociology of Science.** Social factors in the origin of broad theoretical orientations in science, such as the mechanistic doctrine, vitalism, historicism, atomism, holism, relativism, and indeterminism; social effects of these orientations; the social origin of scientists; ethos of science; the relationship of science to culture change; and the variety and nature of scientific institutions. Prerequisite: Sociology 311 or consent of instructor. 1 unit.
413. **Computer Applications in Social Science Statistical Research.** Same as Computer Science 413 and Psychology 413. Computer procedures for the analysis of sociological and psychological data, including probability matrices, dominance matrices, clique analysis, regression analysis, analysis of variance and covariance, canonical correlations, discriminant analysis, and factor analysis. Prerequisite: Sociology 387 or equivalent in statistics; may be taken concurrently with Sociology 387. 1 unit.
414. **Seminar on Social Interaction.** Same as Communications 414. An analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas; presentation of problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
415. **Survey Research Methods, I.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course is devoted mainly to planning of the project. Sociology 416, which is devoted to execution of the research project, must be taken in the following semester. For credit, both semesters must be taken in sequence. Three to ten hours of laboratory time per week. 1 unit.
416. **Survey Research Methods, II.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course sequence will be devoted mainly to execution of the research project. For credit this course must be taken in the semester following Sociology 415. Three to ten hours of laboratory time per week. 1 unit.
417. **Seminar in the Sociology of Law.** Review and analysis of selected areas of theory and research in the sociology of law; focus varies from year to year; topics covered in different years include such areas as civil litigation and the civil courts, police operations and the sociology of law and order, sociological theories of justice, and the operations of legal agencies. Students should consult the instructor about the area to be covered in a particular semester. Prerequisite: Sociology 317. 1 unit.
418. **Seminar in Industrial and Economic Sociology.** Same as Labor and Industrial Relations 418. Discussion and individual research on such topics as industrialization; labor-management relations as group relations; the interrelations of industry and community; technology and the structure of controls in industry; and the problem of a social economics. Prerequisite: Sociology 318 or Labor and Industrial Relations 318, or consent of instructor. 1 unit.
421. **Seminar on Research in Marriage and Family Life.** Analysis of relationships between research methodology and conceptual schemes employed to study family life; critical examination of typical studies which illustrate alternatives in the conceptualization of

- family interaction and the nature of the family unit. Prerequisite: Consent of instructor. 1 unit.
422. **Theory of Social Groups.** A comparative survey of selected conceptual systems currently used for the analysis of human groups; systems are examined with a view to determining the origins and referents of the concepts, their interrelations, and their utility as sources of testable generalizations relevant to the solution of empirical problems in group analysis. 1 unit.
425. **Racial and Cultural Minorities.** Study of the factual and conceptual aspects of minority status as determined by racial and cultural criteria. Prerequisite: Undergraduate major or minor in sociology or anthropology. 1 unit.
429. **Seminar in the Sociology of Religion.** Detailed examination of research in the sociology of religion; the substantive character of religious groups and institutions as revealed by this research; significance of the research in the light of sociological theory and of other fields of sociological concern; and the value of the current research methodology. Prerequisite: Sociology 400. 1 unit.
432. **Special Problems in Theory and Research on Deviant Behavior.** A seminar concerned with the critique of recent theory and research on selected problems in the study of delinquency, crime, mental disorder, and the collaborative development of new theory and research designs. Prerequisite: Sociology 331 and 333, or consent of instructor. 1 unit.
440. **Political Sociology.** An analysis of the impact of social cleavages and cohesion on the operation of political institutions and movements; the place of conflict and power in sociological theory; composition and behavior of power elites; participation in political associations; national and local power structure; social functions of electoral behavior; and modern national and mass political movements. Prerequisite: A course in sociological theory or consent of instructor. 1 unit.
444. **Seminar in Public Opinion.** Same as Communications 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; and mass media and public opinion. 1 unit.
449. **The Sociology of Sport.** Same as Physical Education 449. Sociological analysis of sport with emphasis on sociological theory; sport and games in cross-cultural analysis; sport's structure and function in modern industrialized society; the system of sport in regard to its role structure, formal organization, and professionalization; its differentiation along social class, age, and sex; and sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
450. **Problems of Soviet Society in Transition.** This seminar examines certain major problems inherent in directed social change from an agricultural to an industrial system under a totalitarian regime of the Soviet type; attention focused on such areas as the different phases of the revolutionary process, inconsistencies between ideological premises and the demands of industrialism, the unanticipated consequences of social change, the simultaneous impact upon the social system of industrialism and totalitarianism, and implications of the Soviet experience for other countries. Prerequisite: Consent of instructor. 1 unit.
456. **Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Psychology 453. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program, or consent of instructor. 1 unit.
457. **Organizational Sciences, II.** Same as Business Administration 411, Political Science 461, and Psychology 454. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the

capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Sociology 456. 1 unit.

474. **Survey Methods in Marketing Research.** Same as Business Administration 471. An analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Sociology 185 or Economics 171, or equivalent. 1 unit.
476. **Urban Communities and Urbanization.** Intensive study of special aspects of the urbanization process as it affects the life of communities in this and in other countries. 1 unit.
477. **Seminar on Community Organization.** Same as Rural Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
480. **Sociological Theory and Method.** Concerned with the strategy and tactics involved in the construction of specific substantive theories; considers such problems as concept formation, the use and development of models, criteria of good theory, and the role of theory in the development of sociological research. 1 unit.
482. **Recent Developments in Sociology.** Intensive study of selected topics based on contemporary works of major importance in the development of sociological theory. 1 unit. May be repeated for a total of 2 units.
484. **The Sociological Theory of Talcott Parsons.** Systematic description of the social system and comparison with the personality and cultural subsystems within the general action system; examination of the theory of structural change in social system. Prerequisite: Sociology 300 or 400. 1 unit.
485. **The Sampling of Human Populations and Social Organizations.** Same as Business Administration 485 and Psychology 485. Covers procedures for selecting samples from and estimating population parameters for human populations and social organizations; types of sample designs treated include simple random samples, and stratified and cluster samples together with random number and systematic selection techniques; and emphasis on the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or Economics 371, or consent of instructor. 1 unit.
486. **Seminar on Experimental Sociology.** The logic, design, and analysis of laboratory and field experiments, with special emphasis on the controlled investigation of social processes. Prerequisite: Sociology 385 or equivalent, or consent of instructor. 1 unit.
487. **Special Problems in Rural Sociology.** Same as Rural Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. $\frac{1}{2}$ or 1 unit.
490. **Individual Topics in Sociology.** Supervised individual investigation or study of a topic not covered by regular courses; topic selected by the student and the proposed plan of study must be approved by the adviser and the staff member who supervises the work. $\frac{1}{2}$ to 2 units.
492. **Seminar on Models for Directed Change.** Same as Social Work 492 and Urban Planning 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels; construction of models as interpretations of behavioral science theory; extrapolation of hypotheses and of guides to intervention from the models; and reading from several disciplines as relevant. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Educational Psychology 494 and Psychology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scal-

ing. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.

499. **Thesis Research.** 0 to 4 units.

SPANISH, ITALIAN, AND PORTUGUESE

(Including Catalan, Romance Linguistics, and Rumanian)

Head of Department: Professor A. M. Pasquariello

Department Office: 4080 Foreign Languages Building, Urbana

Catalan

- 301. **Studies in Catalan Language.** An introductory study of the Catalan language. Prerequisite: Eight hours of Latin or any Romance language. 2 hours or ½ unit.
- 302. **Studies in Catalan Literature.** An introductory study to major works of Catalan literature. Prerequisite: Catalan 301. 2 hours or ½ unit.

Italian

- 101. **Elementary Italian.** For students who have no credit in Italian. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
- 102. **Elementary Italian.** Continuation of Italian 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Italian 101 or one year of high school Italian. 4 hours.
- 103. **Intermediate Italian.** Rapid reading, review of grammar, composition, and conversation. Prerequisite: Italian 102 or two years of high school Italian. 4 hours.
- 104. **Intermediate Italian.** Continuation of Italian 103. Prerequisite: Italian 103 or three years of high school Italian. 4 hours.
- 199. **Undergraduate Open Seminar.** 0 to 9 hours.
- 209. **Italian Syntax and Phonetics.** An introduction to the advanced study of the language, with elements of applied phonetics and syntax. Prerequisite: Italian 104 or consent of instructor. 3 hours.
- 211. **Composition and Conversation, I.** Training in oral-aural skill and in writing; practice in the language laboratory required. Prerequisite: Italian 104 or consent of instructor. 3 hours.
- 212. **Composition and Conversation, II.** Continuation of Italian 211. Prerequisite: Italian 211 or consent of instructor. 3 hours.
- 221. **Introduction to Italian Literature, I.** Introduction to representative works and movements of Italian literature since the Renaissance. Prerequisite: Italian 104 or consent of instructor. 3 hours.
- 222. **Introduction to Italian Literature, II.** Introduction to representative works and movements of Italian literature in the Middle Ages and the Renaissance. Prerequisite: Italian 221 or consent of instructor. 3 hours.
- 290. **Readings in Italian.** Readings chosen in consultation with an adviser. Prerequisite: Italian 104 or consent of instructor. 2 to 4 hours. May be repeated for credit.
- 291. **Senior Thesis.** For candidates for honors in Italian. 2 hours.
- 292. **Senior Thesis.** For candidates for honors in Italian. 2 hours.
- 311. **Dante: La Divina Commedia, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or ½ unit.

312. **Dante: La Divina Commedia, II.** Prerequisite: Italian 311 or consent of instructor. 3 hours or ½ unit.
313. **The Divine Comedy.** Same as Comparative Literature 313. An interpretation of Dante's Divine Comedy with special attention to its position in the medieval world; a knowledge of Italian not required. Prerequisite: Junior standing. 2 hours or ½ unit.
321. **Modern Italian Literature, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or ½ unit.
322. **Modern Italian Literature, II.** Prerequisite: Italian 321 or 222, or consent of instructor. 3 hours or ½ unit.
331. **Italian Culture.** Introduction to factors that have shaped present-day Italy; basic concepts contributing to understanding its present social and cultural development. Prerequisite: Italian 211 or 221, or consent of instructor. 3 hours or ½ unit.
362. **Introduction to Romance Linguistics.** Same as French, Linguistics, Portuguese, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or ½ unit.
400. **Beginning Course for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 hours. No graduate credit.
401. **Readings in Italian for Graduate Students.** An intensive language course designed to teach reading skills to graduate students; a continuation of Italian 400. Prerequisite: Italian 400 or consent of instructor. 4 hours. No graduate credit.
403. **Storia della letteratura italiana, I.** Intellectual and literary movements in Italy from the thirteenth century to the Renaissance. 1 unit. May be repeated for credit.
404. **Storia della letteratura italiana, II.** Intellectual and literary movements in Italy from the baroque to the present. Prerequisite: Italian 403. 1 unit. May be repeated for credit.
411. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit.
412. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit.
415. **Italian Literature of the Renaissance.** 1 unit.
416. **Italian Literature of the Renaissance.** 1 unit.
422. **Manzoni e il romanticismo europeo.** Manzoni and the romantic movement. Prerequisite: Italian 321 and 322, or equivalent. 1 unit.
451. **History of the Italian Language.** 1 unit.
452. **Seminar in Italian Linguistics.** 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Linguistics, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Italian 362 or consent of instructor. 1 unit.
491. **Special Topics in Italian.** ½ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

Portuguese

101. **Elementary Portuguese, I.** For students who have no credit in Portuguese. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.
102. **Elementary Portuguese, II.** Continuation of Portuguese 101. Prerequisite: Portuguese 101. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.
103. **Intermediate Portuguese.** Rapid reading, review of grammar, composition, and conversation. Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 4 hours.
104. **Intermediate Portuguese.** Continuation of Portuguese 103. Prerequisite: Portuguese 103 or three years of high school Portuguese. 4 hours.

111. **Elementary Portuguese.** For students who have no credit in Portuguese. All students in this course are required to register for two hours per week in the language laboratory. 8 hours.
112. **Intermediate Portuguese.** Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 8 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
209. **Portuguese Syntax and Phonetics.** An introduction to the advanced study of the language with basic elements of applied phonetics and syntax. Must be taken with Portuguese 211. Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours.
211. **Composition and Conversation, I.** Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours.
212. **Composition and Conversation, II.** Prerequisite: Portuguese 211 or consent of instructor. 3 hours.
221. **Introduction to Portuguese Literature.** Survey of the most representative works from the Middle Ages to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 104 or 112, or consent of instructor upon demonstrating competency in reading Portuguese. 3 hours.
222. **Introduction to Brazilian Literature.** Survey of the most representative works from the sixteenth century to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 221 or consent of instructor. 3 hours.
290. **Readings in Portuguese.** Readings chosen in consultation with a departmental adviser. Prerequisite: Portuguese 104 or 112, or consent of instructor. 2 to 4 hours.
301. **Brazilian Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or ½ unit.
302. **Portuguese Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or ½ unit.
303. **Luso-Brazilian Culture.** Affords a broad understanding of the origins of Luso-Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or ½ or 1 unit.
304. **Brazilian Culture.** Affords a broad understanding of contemporary Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or ½ or 1 unit.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, and Romance Linguistics 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or consent of instructor. 3 hours or ½ unit.
405. **Structure of Brazilian Portuguese: Phonology.** Phonetics and phonemics of modern Brazilian Portuguese. Prerequisite: Portuguese 104 or consent of instructor. 1 unit.
406. **Structure of Brazilian Portuguese: Morphology and Syntax.** Morphemics and syntax of modern Brazilian Portuguese. Prerequisite: Portuguese 405 or consent of instructor. 1 unit.
407. **Studies in Brazilian Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Brazilian literature; subject matter varies each time the course is offered. Prerequisite: Portuguese 301 or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
408. **Studies in Portuguese Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Portuguese literature; subject matter varies each time the course is offered. Prerequisite: Portuguese 302 or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Portuguese 362 or consent of instructor. 1 unit.
491. **Special Topics in Portuguese.** ½ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

Romance Linguistics

362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, and Portuguese 362, and Spanish 364. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or ½ unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Romance Linguistics 362 or consent of instructor. 1 unit.

Rumanian

301. **Structure of Rumanian.** Analysis of the sound system and grammar of contemporary literary Rumanian. 3 hours or ½ unit.
302. **Structure of Rumanian.** Analysis of the sound system and grammar of contemporary literary Rumanian. Prerequisite: Rumanian 301. 3 hours or ½ unit.

Spanish

101. **Elementary Spanish.** For students who have no credit in Spanish. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.
102. **Elementary Spanish.** Continuation of Spanish 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Spanish 101 at the University of Illinois at Urbana-Champaign. All other second semester Spanish students should enroll in Spanish 122. 4 hours.
103. **Intermediate Spanish, I.** Rapid reading review of grammar, composition, conversation, and reading for students who may be interested in pursuing Spanish in advanced courses. There will be a series of supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. With Spanish 104, 124, 134, or 114, this course fulfills the foreign language requirement. Prerequisite: Spanish 102 or 105 or 122, or assignment by placement test. 4 hours.
104. **Intermediate Spanish, II.** Continuation of Spanish 103 for students who may be interested in pursuing Spanish in more advanced courses. Completion of this course fulfills the college foreign language requirement. Prerequisite: Spanish 103 or 123, or assignment by placement test. 4 hours.
105. **Intensive Beginning Spanish.** Equivalent to Spanish 101 and 102, for students with no prior Spanish credit who wish to learn at a rapid rate; speaking, reading, writing, and aural comprehension. 8 hours.
107. **Intensive Intermediate Spanish.** For students who wish to complete Spanish 103 and 104 at a rapid rate. Grammar review, readings, and cultural history; conducted in Spanish. Prerequisite: Spanish 102 or 122, or equivalent placement score. 8 hours.
114. **Conversational Spanish.** Conversation in Spanish on topics of current interest; brief grammar review as necessary to improve oral skills; and some reading required in preparation for classroom discussions. Fulfills the foreign language requirement but does not serve as prerequisite for advanced courses in Spanish without departmental approval. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
115. **Elementary Composition and Conversation.** A beginning composition and conversation course at the level of difficulty of Spanish 103 and 104; may be taken concurrently with Spanish 103 or 104, but does not count toward the major in Spanish. Prerequisite: Spanish 102 or two years of high school Spanish. 2 hours.

122. **Elementary Spanish.** Second-semester Spanish course for all students who did not take Spanish 101 at this University. Prerequisite: Spanish 101 elsewhere or assignment by placement exam. 4 hours.
123. **Reading and Speaking Spanish, I.** Readings in Spanish of literary and cultural texts with discussion in Spanish; some grammar essential to development of reading and oral skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. With Spanish 104, 124, 134, or 114, this course fulfills the foreign language requirement. Students planning to take advanced courses in Spanish should enroll in Spanish 103. Prerequisite: Spanish 102, 122, or 105, or equivalent placement score. 4 hours.
124. **Reading and Speaking Spanish, II.** Continuation of Spanish 123; readings in Spanish literary and cultural texts with discussion in Spanish; includes some grammar essential to the development of reading and oral skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. Fulfills the foreign language requirement, but does not serve as a prerequisite for more advanced courses in Spanish without departmental approval. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
134. **Reading Spanish.** Readings in Spanish texts with discussion in English; some grammar essential to development of reading skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. Fulfills the foreign language requirement, but does not serve as a prerequisite for advanced courses in Spanish without departmental approval. Readings will focus on Latin American politics, Spanish institutions, twentieth century Hispanic literature, twentieth century concerns in Hispanic societies, etc. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
200. **Literary Analysis.** Study of literary styles and techniques of analysis as applied to major genres of Hispanic literature. Prerequisite: Spanish 104 or consent of instructor. 2 hours.
209. **Spanish Language.** A practical course on Spanish phonology and morphology; intensive drill in Spanish sound and verb systems, and analysis of sentence structure. Prerequisite: Spanish 104 or consent of instructor. 3 hours.
211. **Oral Spanish.** Practice in speaking Spanish; to be taken concurrently with or subsequent to Spanish 209. Meets four hours per week. Prerequisite: Spanish 104. 2 hours.
215. **Intensive Spoken Spanish.** Intensive oral contact with Spanish; meets five hours per week; and required for teacher-training majors in Spanish. Prerequisite: Spanish 211 or consent of instructor. 2 hours. May be repeated once for credit.
217. **Spanish Composition, I.** Basic composition course; problems of written Spanish and principles of Spanish rhetorical patterns; introduction to Spanish metrics and poetic forms; and weekly written exercises. Prerequisite: Spanish 209 and junior standing, or consent of instructor. 3 hours.
218. **Spanish Composition, II.** Continuation of Spanish 217. Incorporation of principles of commercial written Spanish. Prerequisite: Spanish 217 or equivalent. 3 hours.
225. **Spanish for Near Native Speakers.** Review of Spanish pronunciation, orthography, syntax, and vocabulary for students of Hispanic background who have little or no formal training in the Spanish language. Prerequisite: Consent of advisor and instructor. 3 hours.
232. **Culture of Spain.** Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 2 hours.
233. **Culture of Spanish America.** Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 2 hours.
240. **Spanish Literature: Medieval and Golden Age.** Introduction to major works and movements of the Middle Ages and the Golden Age. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.

241. **Spanish Literature: Eighteenth Century to the Present.** Study of representative masterpieces within the context of major periods and trends. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.
242. **Spanish-American Literature.** Introduction to major literary movements and works in Spanish America. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.
250. **The Worlds of Jorge Luis Borges and Julio Cortazar.** The major works of two of the most important contemporary writers of Spanish-American fiction will be read in translation and analyzed in English. 3 hours.
280. **Teachers Course.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or 211, or consent of instructor. 4 hours.
291. **Senior Thesis.** For candidates for honors in Spanish. 2 hours.
292. **Senior Thesis.** For candidates for honors in Spanish. 2 hours.
299. **Senior Seminar.** Intensive study of Hispanic linguistics or literature. Prerequisite: Senior standing. 2 hours. May be repeated for credit with adviser's consent.
305. **Romanticism and Realism in Nineteenth-Century Spanish Literature.** A study of representative authors and genres of the nineteenth century; particular emphasis on the romantic drama and the realistic novel. Prerequisite: Spanish 241 or equivalent. 3 hours or ½ unit.
306. **The Generation of 1898.** A study of representative works of Baroja, Azorin, Unamuno, Maeztu, Valle Inclán, Benavente, A. Machado, and others. Prerequisite: Spanish 241 or equivalent. 3 hours or ½ unit.
307. **Spanish-American Literature to 1888.** Study of the development of Spanish-American literature from the sixteenth century through the end of the romantic period. Prerequisite: Spanish 242 or equivalent. 3 hours or ½ unit.
308. **Spanish-American Modernismo.** A study of Spanish-American literature from 1888 to the end of World War I. Prerequisite: Spanish 242 or equivalent. 3 hours or ½ unit.
309. **Introduction to Medieval Spanish Literature.** Historical and cultural background for the Middle Ages; selected readings in medieval literature from the Jarchas to Corbacho. Prerequisite: Spanish 240 or equivalent. 2 hours or ½ unit.
310. **Contemporary Spanish-American Literature.** A study of Spanish-American literature from World War I to the present. Prerequisite: Spanish 242 or equivalent. 3 hours or ½ unit.
311. **Don Quixote and the Prose of the Golden Age.** Introduction to Don Quixote, to its relationship to other selected masterpieces of the Golden Age, and to the main currents and forms of Golden Age prose. Prerequisite: Spanish 240 or equivalent. 2 hours or ½ unit.
314. **Spanish Drama and Poetry of the Golden Age.** Prerequisite: Spanish 240 or equivalent. 2 hours or ½ unit.
351. **Phonetics.** Prerequisite: Spanish 209 or equivalent. 2 hours or ½ unit.
352. **Syntax.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or equivalent. 2 hours or ½ unit.
353. **Spanish Structure.** Same as Linguistics 353. Comprehensive analysis of Spanish phonology and syntax based on present-day linguistic theory. Prerequisite: Linguistics 300; Spanish 351; Spanish 352. 3 hours or ½ unit.
361. **Spanish Abroad, I.** Lectures, seminars, and practical work in Spanish language, literature, and civilization, in Spain. Prerequisite: Spanish 211 or equivalent; Spanish 200 or equivalent; 3.5 overall average; 4.0 average in Spanish courses. 0 to 15 hours, or 0 to 4 units.
362. **Spanish Abroad, II.** Lectures, seminars, and practical work in Spanish language, literature, and civilization, in Spain. Prerequisite: Spanish 361. 0 to 15 hours, or 0 to 4 units.
364. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 362. Comparative and historical analysis of the Ro-

- mance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or ½ unit.
371. **Spanish for Teachers.** A consideration of language problems suggested by teaching experience. Prerequisite: Spanish 209 or equivalent. 2 hours or ½ unit. Offered in the summer session only.
382. **Language Laboratory Techniques.** Same as French, German, and Slavic 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level or equivalent. 2 hours or ½ unit.
400. **Beginning Spanish for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 hours. No graduate credit.
401. **Readings in Spanish for Graduate Students.** Continuation of Spanish 400; special readings in the critical literature of several disciplines. Prerequisite: Spanish 400 or consent of instructor. 4 hours. No graduate credit.
405. **Spanish Bibliography.** An introduction to bibliographical method and to the principal bibliographical resources for the study of Spanish and Latin American literature. ½ unit.
411. **Medieval Literature to 1300.** Survey of medieval Spanish literature to 1300; special attention to relationship with other medieval literatures of western Europe. Prerequisite: Spanish 309. 1 unit.
412. **Medieval Literature, 1300-1500.** Survey of medieval Spanish literature from 1300 to 1500; special attention to relationship with other medieval literatures of western Europe. Prerequisite: Spanish 309. 1 unit.
415. **Renaissance and Baroque Prose in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
417. **Renaissance and Baroque Drama in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
418. **Seminar in Renaissance and Baroque Literature.** 1 unit. May be repeated for credit.
419. **Cervantes. Don Quixote and representative minor works.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
421. **Modern Spanish Novel and Essay.** 1 unit.
422. **Contemporary Spanish Novel and Essay.** 1 unit.
423. **Modern Spanish Drama.** Dramatic literature of Spain in the eighteenth and nineteenth centuries. 1 unit.
424. **Contemporary Spanish Drama.** Dramatic literature of Spain in the twentieth century. 1 unit.
425. **Renaissance and Baroque Poetry in Spain.** 1 unit.
426. **Spanish Poetry of the Nineteenth and Twentieth Centuries.** 1 unit.
427. **Studies in Twentieth-Century Spanish Literature.** Advanced study of major literary movements, genres, or authors in twentieth-century Spanish literature; subject matter varies. Prerequisite: Spanish 306 or any survey of contemporary Spanish literature, or equivalent. 1 unit. May be repeated for a maximum of 2 units.
428. **Studies in Nineteenth-Century Spanish Literature.** Advanced study of major literary movements, genres, or authors in nineteenth-century Spanish literature; subject matter varies. Prerequisite: Spanish 305 or equivalent. 1 unit. May be repeated for a maximum of 2 units.
429. **Studies in Golden Age.** Advanced study of major literary movements, genres, or authors in sixteenth- and seventeenth-century Spanish literature; subject matter varies. Prerequisite: Spanish 311 or 314, or any survey of Spanish literature. 1 unit. May be repeated for a maximum of 2 units.
430. **Studies in Twentieth-Century Spanish-American Literature.** Advanced study of major literary movements, genres, or authors in twentieth-century Spanish-American literature; subject matter varies. Prerequisite: Spanish 307, 308, or 310, or equivalent. 1 unit. May be repeated for a maximum of 2 units.

431. **Spanish-American Poetry to 1920.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
432. **Contemporary Spanish-American Poetry.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
433. **Spanish-American Novel to 1945.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
434. **Spanish-American Novel Since 1945.** Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
435. **Seminar in Spanish-American Poetry.** Prerequisite: Spanish 431 or 432. 1 unit.
436. **Seminar in Spanish-American Novel.** Same as Comparative Literature 462. Special problems in methodology and research; includes other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit.
437. **Spanish-American Drama.** Prerequisite: Spanish 307, 308, or 310. 1 unit.
438. **Spanish-American Essay.** Prerequisite: Spanish 307, 308, or 310. 1 unit.
439. **The Spanish-American Short Story.** Intensive and analytical study of the principal cuentistas of Spanish America. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
442. **Seminar in Modern Spanish Literature.** Study of problems in the works of a major writer or group of writers of the eighteenth or nineteenth centuries. Prerequisite: Spanish 305; Spanish 421 or 423, or equivalent. 1 unit.
443. **Seminar in Galdos.** Research work in novelistic criticism. Prerequisite: Spanish 421 or 422. 1 unit.
444. **Seminar in Spanish Realism and Naturalism.** Research work in nineteenth-century literary theory and practice in novel and drama. Prerequisite: Spanish 421 and 442. 1 unit.
445. **Seminar in Twentieth-Century Spanish Literature.** Investigation of literary problems presented by the Spanish novel, drama, and/or essay since 1900. Prerequisite: Spanish 421, 422, 423, or 424, or equivalent. 1 unit.
451. **Seminar in Spanish Descriptive Linguistics.** Selected topics of Spanish phonology and syntax in the light of present-day linguistic theory. Prerequisite: Consent of instructor. 1 unit.
452. **Seminar in Spanish Historical Linguistics.** Selected topics on the development of Spanish and its dialects in the light of present-day historical methods. Prerequisite: Consent of instructor. 1 unit.
453. **History of the Spanish Language.** 1 unit.
454. **Old Spanish.** 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 462. Selected topics in comparative Romance linguistics. Prerequisite: Spanish 362 or consent of instructor. 1 unit.
463. **College Teaching of Foreign Languages.** Same as English as a Second Language, French, German, and Russian 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
471. **Applied Linguistics and Teaching College Spanish.** Study of the structure of Spanish with special emphasis on the teaching situation in elementary Spanish courses. ½ unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, German, and Russian 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Spanish 463 or consent of instructor.
491. **Special Topics in Spanish.** ½ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

SPECIAL EDUCATION

Chairman of Department: Professor G. M. Spriggs

Department Office: 1005 West Nevada Street, Urbana

117. **Exceptional Children.** Introduction to the study of children who deviate from the average in mental, physical, and social characteristics, including a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. Prerequisite: Sophomore standing and/or Psychology 100. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
302. **Manual Communication, I.** Same as Speech and Hearing Science 302. Study of methods of manual communication with hearing impaired individuals; analysis of the language of signs and fingerspelling in relation to origins, development, and structure; and extensive practice in manual communication. 2 hours or ½ unit.
303. **Manual Communication, II.** Same as Speech and Hearing Science 303. Continuation of Special Education 302. In-depth study of manual methods of communicating with hearing-impaired individuals; particular emphasis on development of fluency in communicating with language-deficient deaf children and adults; and extensive practice in idiomatic language of signs. Prerequisite: Special Education 302 or consent of instructor. 2 hours or ½ unit.
314. **Laboratory in Measurement of Exceptional Children.** Practice in administering, scoring, interpreting, and communicating the results of educational tests which may appropriately be given to exceptional children by classroom teachers; practicum sections offered by areas of exceptionality: mental retardation, learning disabilities, gifted, deaf, emotionally disturbed, and culturally disadvantaged. Prerequisite: Credit or concurrent registration in Special Education 324; consent of instructor. 2 hours or ½ unit. May be repeated once; maximum credit is not to exceed 4 hours or 1 unit.
315. **Psychoeducational Programming for Emotionally Disturbed Children.** Skill-building experience in teaching emotionally disturbed children; classroom focus on developing skills in instructional alternatives, observational analysis, analyzing behavior, diagnosis, behavioral management, remediation procedures, curriculum considerations, and relationship process; and personal-professional characteristics needed to teach emotionally disturbed children. Prerequisite: Special Education 321; consent of instructor. 4 hours or 1 unit.
316. **The Gifted Child in School and Society.** A consideration of the gifted in society; who they are, their physical, psychological, social, and educational characteristics, and society's needs and provisions for them. The major portion of the course is devoted to the consideration and evaluation of instructional and administrative adjustments that should be made for the gifted in the educational structure. Prerequisite: Educational Psychology 211 or 236; consent of instructor. 3 hours, or ½ to 1 unit.
317. **Psychosocial Educational Aspects of Deafness.** Same as Speech and Hearing Science 317. Historical and current societal perceptions of the deaf; an analysis of the various effects and patterns of auditory impairment on children and adults; intelligence, personal and social adjustment; and the psychological processes and how they affect the acquisition of language, speech, speech reading, reading, and writing. Prerequisite: Special Education 117; Psychology 100 or Educational Psychology 211. 3 hours, or ½ to 1 unit.

- 318. Workshop and Laboratory in Education of Exceptional Children.** For those specializing in exceptional children the following sections may be offered: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; and (g) the culturally disadvantaged. Prerequisite: Consent of instructor. 4 to 8 hours, or 1 to 2 units.
- 319. Special Education of the Deaf, I.** Same as Speech and Hearing Science 319. Survey of the curriculum and techniques in preschools, kindergarten, primary, and intermediate levels as applied to the hard-of-hearing, deafened, and deaf child; study of sense training, lip reading, vocabulary development, reading techniques, elementary school subjects, language and speech development, auditory training, and curriculum construction. Prerequisite: Consent of instructor. 5 hours, or 1 to 1 1/2 units.
- 320. Special Education of the Deaf, II.** Same as Speech and Hearing Science 320. Continuation of Special Education 319. Prerequisite: Special Education 319. 5 hours, or 1 to 2 units.
- 321. Education of Disturbed and Conduct-Problem Children.** Study of the social, emotional, and learning characteristics of children who are disturbed or who exhibit problems of conduct; methods of diagnosis and differentiation; and educational environments and teaching methods used for their remediation. Prerequisite: Special Education 117 or equivalent; Educational Psychology 236 or equivalent; consent of instructor. 3 hours, or 1/2 or 1 unit.
- 322. Psychology and Education of the Mentally Handicapped, I.** Study of the social, emotional, physical, and learning characteristics and problems of mentally handicapped children; identification and diagnosis; available services and provisions; and educational programs and curriculum of the school. Prerequisite: Consent of instructor. 3 hours or 1/2 unit.
- 323. Psychology and Education of the Mentally Handicapped, II.** Techniques, methods, and materials for teaching mentally handicapped children; principles underlying course of study, parent counseling, and use of records. Prerequisite: Senior standing in special education; consent of instructor. 3 hours or 1/2 unit.
- 324. Mental and Educational Measurement of Exceptional Children.** Theoretical and practical considerations in psychological and educational evaluation of exceptional children; emphasis on understanding the technical and practical aspects of current testing procedures and their application to the education of exceptional children. Prerequisite: Special Education 117; consent of instructor. 3 hours or 1/2 unit.
- 416. Problems in Mental Deficiency.** An advanced course in mental deficiency, covering definitions, theories, classifications, etiology, diagnosis, and social, medical, psychological, and educational rehabilitation procedures; emphasis on the contributions of biology, sociology, anthropology, and psychology to educational theory and practice with reference to the mentally deficient. Prerequisite: Special Education 322 or consent of instructor. 1 unit.
- 417. Psychoeducational Problems of Exceptional Children.** A course for educators, students in the behavioral sciences, and students beginning graduate study in special education; study of relevant research dealing with the physical, mental, emotional, and social traits of all types of exceptional children, and consideration of major current problems in the development of educational programs. Prerequisite: Sixteen hours of psychology and/or education, or consent of instructor. 1 unit.
- 418. Communicative Problems of the Deaf.** Same as Speech and Hearing Science 418. An advanced course in the problems and procedures involved in the acquisition of language and communication by persons with severe hearing impairment, particularly those with profound prelingual deafness; emphasis on research and measurement in the development of speech, speech reading, residual hearing, reading, written language, and manual communication, including finger spelling and the language of signs; and stress on the applications of recent approaches in linguistics and psycholinguistics to language development. Prerequisite: Consent of instructor. 1 unit.

419. **Diagnosis of Learning Disabilities.** Study of the advanced theory and technology of learning disabilities with special reference to etiology and diagnosis; major emphasis on the psychoneurological, genetic, and psycholinguistic aspects of reading disorders; coverage of remediation which is implicit in diagnostic procedure; and required laboratory practice. This is the first half of a year's sequence with Special Education 444. Prerequisite: Special Education 318 (b); Psychology 443 or Educational Psychology 343; Special Education 456 (b); consent of instructor. 1 unit.
420. **The Social Psychology of the Handicapped.** Study of the social and emotional adjustment of handicapped children and adults, and of the somatopsychological significance of mental, sensory, and motor variations in the adjustive process; evaluation of effects of limitations imposed by the attitude of society, the attitude of the individual toward his handicap, and the handicap itself; and analysis of implications for current educational programs for the handicapped. Prerequisite: Special Education 117 or 417; Educational Psychology 312; or consent of instructor. 1 unit.
421. **Administration and Supervision of Special Education.** Designed for advanced graduate students preparing for administrative or supervisory positions in special education programs; examination of administrative and supervisory practices in educating exceptional children with emphasis on special education programs in the public schools; and application of administrative theory to special education programs. Field trips to observe and evaluate programs are required. Prerequisite: Special Education 417; Educational Administration 460; consent of instructor. 1 unit.
444. **Remediation of Learning Disabilities.** Theory and practice of remediation of children with learning disabilities, with emphasis on matching a wide variety of methods to specific deficits; advanced diagnostic procedures and teaching, prescription writing, and evaluative monitoring. The course includes supervised clinical practice. Prerequisite: Special Education 318 (b) and 419. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the dean of the College of Education.
456. **Problems and Trends in Special Education.** Introduction to significant problems, points of view, and trends in the field concerned; exploration of significant research related to organization, content, and techniques in the field in question. Students are encouraged to make special studies in approved areas. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; and (g) culturally disadvantaged children. Prerequisite: Consent of instructor. 1 to 2 units.
459. **Workshop in Curriculum Development.** Curriculum development projects in specialized fields of special education. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; (g) culturally disadvantaged children; and (h) preschool children. 1 to 2 units.
490. **Seminar for Advanced Students of Education.** Seminar in the education of exceptional children; open only to persons who have been admitted for doctoral study. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; (g) culturally disadvantaged children; (h) administration; (i) behavior modification; and (j) special education. 1 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student presents his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design

stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Limited to students who have been admitted for doctoral study. 1 to 2 units.

499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

SPEECH AND HEARING SCIENCE

Head of Department: Professor J. J. O'Neill

Department Office: 601 East John Street, Champaign

105. **Voice and Articulation.** Same as Speech Communication 105. Basic factors of voice and speech sound production; analysis of faults that result in minor speech deviations or inadequacies; and individual analysis and guided practice toward improvement of speech habits. 2 hours.
109. **Introduction to Physiological Phonetics.** Basic analysis of the physiological process of producing the sounds of American English; practice in identification and in transcription of normal and deviant speech especially for speech clinicians, hearing therapists, teachers of speech, and teachers of the deaf. 3 hours.
175. **A Survey of Historical and Professional Aspects of Speech Pathology and Audiology.** Survey of the fields of speech pathology and audiology; emphasis on historical and philosophical developments, relations to other professions, professional practice, and function and role in study of human communication. Prerequisite: Sophomore standing. 2 hours.
198. **Freshman Seminar.** A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings; open to undergraduates at any level. Requests for activation of this course may be made by students or by faculty and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours. May be repeated.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
208. **Speech and Hearing Problems in the Classroom.** An orientation of prospective teachers to speech and hearing problems encountered in the elementary and secondary schools; emphasis on description of problems and types of classroom management. Prerequisite: Junior standing. 3 hours.
291. **Honors Course.** Individual study leading either to a thesis or to departmental honors. Prerequisite: Senior standing; a grade point of 4.0 or consent of the head of the department. 2 hours. May be repeated to a maximum of 4 hours.
293. **Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of speech and hearing science, and written approval by the faculty members who will supervise the student's work. 2 hours. May be repeated to a maximum of 4 hours.
301. **General Phonetics.** Same as Speech Communication 301. Basic principles of phonetic study; includes observation and representation of pronunciation, ear training, and practice in transcription. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
302. **Manual Communication, I.** Same as Special Education 302. Study of methods of manual communication with hearing impaired individuals; analysis of the language of signs and fingerspelling in relation to origins, development, and structure; and extensive practice in manual communication. 2 hours or $\frac{1}{2}$ unit.
303. **Manual Communication, II.** Same as Special Education 303. Continuation of Speech and Hearing Science 302; an in-depth study of manual methods of communicating with hearing impaired individuals; particular emphasis on development of fluency in communicating with language-deficient deaf children and adults; and extensive prac-

- tice in idiomatic language of signs. Prerequisite: Speech and Hearing Science 302 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
317. **Psychosocial Educational Aspects of Deafness.** Same as Special Education 317. Historical and current societal perceptions of the deaf; an analysis of the various effects and patterns of auditory impairment on children and adults; intelligence, personal and social adjustment, and the psychological processes and how they affect the acquisition of language, speech, speech reading, reading, and writing. Prerequisite: Special Education 117; Psychology 100 or Educational Psychology 211. 3 hours, or $\frac{1}{2}$ to 1 unit.
319. **Special Education of the Deaf, I.** Same as Special Education 319. Survey of the curriculum and techniques in preschools, kindergarten, primary, and intermediate levels as applied to the hard of hearing, deafened, and deaf child; study of sense training, lip reading, vocabulary development, reading techniques, elementary school subjects, language and speech development, auditory training, and curriculum construction. Prerequisite: Consent of the instructor. 5 hours, or 1 to $1\frac{1}{2}$ units.
320. **Special Education of the Deaf, II.** Same as Special Education 320. Continuation of Speech and Hearing Science 319. Prerequisite: Speech and Hearing Science 319. 5 hours, or 1 to 2 units.
348. **Speech and Language Clinical Methods in the Schools.** Same as Elementary Education 348. Study of methods and materials used in the schools by the speech and language clinician. Prerequisite: Speech and Hearing Science 388. 3 hours or $\frac{1}{2}$ unit.
375. **Speech Science, I.** Same as Speech Communication 375 and Linguistics 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, and to fundamental acoustics of speech. Prerequisite: Speech and Hearing Science 109 or 301, or consent of instructor. 4 hours or 1 unit.
376. **Speech Science, II.** Same as Speech Communication 376 and Linguistics 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Speech and Hearing Science 375. 4 hours or 1 unit.
377. **The Bases of Speech and Hearing Science.** Same as Speech Communication 377. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, the acoustical characteristics of speech, and the hearing of speech. Not open to students with credit in Speech and Hearing Science 375 or 376. Prerequisite: Speech and Hearing Science 109 or equivalent, and consent of instructor. 3 hours or $\frac{1}{2}$ unit.
378. **Hearing Science.** Acoustics, anatomy, and physiology of the auditory system; psycho-physical methods; and a consideration of auditory theories and mechanics. Prerequisite: Speech and Hearing Science 375. 3 hours or $\frac{1}{2}$ unit.
383. **Development of Spoken Language.** Same as Speech Communication 383. Study of the correlates of language development from the prelinguistic period to adulthood. Prerequisite: Senior standing; consent of instructor. 3 hours or $\frac{1}{2}$ or 1 unit.
385. **Speech Pathology, I.** Study of the causes, symptoms, and treatment of speech disorders, including articulatory, vocal, and rhythmical disorders; observation of clinical techniques required. Prerequisite: Ten hours of speech including Speech and Hearing Science 109, and credit or concurrent registration in Speech and Hearing Science 375, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
386. **Basic Diagnostic and Therapeutic Principles.** Instruction and practice in the administration and interpretation of diagnostic tests; discussion and demonstration of clinical approaches used with speech disorders. Prerequisite: Speech and Hearing Science 385; credit or concurrent registration in Speech 388. 3 hours or $\frac{1}{2}$ unit.
387. **Practicum in Speech Diagnosis and Therapy.** Observation, practice, and research in diagnosis and therapy of speech disorders. Prerequisite: Speech and Hearing Science 386 and 389; grade point average of at least 3.5; consent of instructor. Students may repeat either Speech and Hearing Science 387 or 398, but not both, for 3 hours. 3 hours or $\frac{1}{2}$ unit.

388. **Speech Pathology, II.** Study of causes, symptoms, and treatment of speech disorders; includes stuttering, cerebral palsy, aphasia, and cleft palate. Prerequisite: Speech and Hearing Science 385. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Psychological Appraisal in Speech Pathology and Audiology.** Introduction to principles of diagnostic testing; discussion of administration, scoring, and interpretation of tests used to supplement data obtained during speech, language, and hearing evaluation. Prerequisite: Speech and Hearing Science 383 and 385; a course in tests and measurement; or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
390. **Communication Disorders in Children: Habilitation and Rehabilitation.** Principles of differential diagnosis, therapeutic diagnosis, clinical and classroom habilitation, and rehabilitation of children with communicative disorders etiologically associated with neurological impairment, emotional disturbance, environmental deprivation, bilingualism, and mental retardation. Prerequisite: Speech 383; senior or graduate standing; or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
391. **Introduction to Hearing Disorders.** Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; and principles of retraining the hard-of-hearing. Prerequisite: Speech and Hearing Science 375 and 378, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
392. **Seminar in Development and Measurement of Spoken Language.** A review of the research and practical methodology associated with the development and measurement of spoken language. Prerequisite: Speech 383 or consent of instructor. 3 hours or 1 unit.
393. **Aural Rehabilitation.** Principles and methods of clinical and classroom retraining of the hard-of-hearing; includes lip reading, auditory training, speech disorders and conversation, and counseling. Required in curriculum of teacher training in speech and hearing science. Prerequisite: Speech and Hearing Science 391; grade point average of at least 3.5; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
394. **Hearing Conservation.** Survey of auditory screening methods, educational and protective measures, and follow-up procedures utilized in public health, public school and college, and military and industrial settings. Prerequisite: Speech and Hearing Science 391 and 395. 3 hours, or $\frac{1}{2}$ or 1 unit.
395. **Audiometry.** Principles and application of basic audiometry. Prerequisite: Speech and Hearing Science 391 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
396. **Diagnosis of Hearing Impairments in Infants and Young Children.** Symptoms and causes of hearing impairment in young children; practice in procedures used for the measurement of residual hearing; and the selection and use of hearing aids. Prerequisite: Speech and Hearing Science 391 and 395, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
397. **Measurement of Auditory Perception.** Principles and methods of clinical assessment of auditory perception; intensive study of measurement techniques for speech perception; applications with clinical clients; and survey of current literature and research. Prerequisite: Speech and Hearing Science 391 and 395. 3 hours, or $\frac{1}{2}$ or 1 unit.
398. **Practicum in Audiology.** Observation, practice, and research in diagnosis and rehabilitation of auditory disorders. Students may repeat either Speech and Hearing Science 387 or 398, but not both, for 3 hours. Prerequisite: Speech and Hearing Science 389 and 393. 3 hours or $\frac{1}{2}$ unit.
399. **Design and Analysis of Experiments in Speech and Hearing Science.** An introduction to experimental designs and methods of statistical analysis in speech and hearing research. Prerequisite: Graduate standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
418. **Communicative Problems of the Deaf.** Same as Special Education 418. An advanced course in the problems and procedures involved in the acquisition of language and communication by persons with severe hearing impairment, particularly those with profound prelingual deafness; emphasis on research and measurement in the development of speech, speech reading, residual hearing, reading, written language, and manual communication, including finger spelling and the language of signs; and stress on

the applications of recent approaches in linguistics and psycholinguistics to language development. Prerequisite: Consent of instructor. 1 unit.

472. **Psychoacoustics of Speech.** Theory and principles of auditory perception of speech; survey of experimental and theoretical literature; and laboratory demonstration and experimentation. Prerequisite: Speech and Hearing Science 375, 376, and 391; or consent of instructor. 1 unit.
475. **Experimental Phonetics, I.** Same as Linguistics 475. Theoretical consideration of speech as motor behavior; special reference to physiological investigations of normal respiration, phonation, and articulation; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
476. **Experimental Phonetics, II.** Same as Linguistics 476. Theoretical consideration of speech as an acoustical phenomenon; special reference to acoustical investigations of voice and speech sounds; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
477. **Measurement of Speech, I.** Same as Linguistics 477. Principles and methods of measuring speech action; special action recorders and transducers; techniques of analysis; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Speech and Hearing Science 475. 1 unit.
478. **Measurement of Speech, II.** Same as Linguistics 478. Principles and methods of measuring the acoustical phenomena of speech; oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design; and laboratory experimentation. Prerequisite: Credit or concurrent registration in Speech and Hearing Science 476; consent of instructor. 1 unit.
481. **Seminar in Neuropathologies of Speech and Language.** Advanced study of speech, vocal, and linguistics problems associated with cerebral palsy and aphasia; topics offered in rotation, one or two each semester, include neurological aspects, aphasia, and cerebral palsy. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 3 units.
482. **Seminar in Stuttering.** Principles, theories, and methods of clinical management of stuttering behavior in children and adults. Prerequisite: Speech and Hearing Science 388. 1 unit.
483. **Psychology of Speech and Hearing Disorders, I.** Same as Psychology 483. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to speech disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
484. **Psychology of Speech and Hearing Disorders, II.** Same as Psychology 484. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
486. **Advanced Clinical Techniques in Speech and Hearing.** Semi-independent management of complex cases; participation in examination and analysis; topics offered each semester include theory of clinical practice, speech pathology, audiology, language disorders, and field study. Prerequisite: Consent of instructor. ½ to 4 units.
488. **Diagnostic Procedures in Pathologies of Speech and Language.** Study of diagnostic procedures used in the analysis of neuropathologies of speech and language, and orofacial and laryngeal pathologies of speech. Prerequisite: Consent of instructor. 1 unit.
489. **Seminar in Orofacial and Laryngeal Pathologies of Speech.** Advanced study of speech and vocal problems associated with cleft palate, laryngeal dysfunctions, and facial-maxillary disturbances; topics offered in rotation, one each semester, include cleft palate and organic vocal problems. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.

490. **Medical Aspects of Speech Disorders and Audiology.** Study of acute and chronic hearing and speech disorders traceable to disease of the ear and vocal mechanisms in relation to the techniques and philosophies utilized in a medically oriented environment. Prerequisite: Speech and Hearing Science 385, 388, and 486. Offered in 1974-75 and in alternate years. 1 unit.
491. **Seminar in Hearing Disorders.** Principles and methods of clinical management of all types of hearing disorders; survey of current literature and research. The following topics are offered in rotation, one or two each semester: automatic audiometry, aural rehabilitation, and hearing aids and amplification. Prerequisite: Speech and Hearing Science 391. 1 unit. May be repeated for a maximum of 3 units.
492. **Advanced Audiology.** Advanced study of rationale and development of principles associated with special techniques, procedures, and methods used in audiology. Prerequisite: Speech and Hearing Science 395 and 397. 1 unit.
495. **Special Problems.** Investigation of speech projects not included in theses. Prerequisite: Consent of head of the department. $\frac{1}{2}$ to 2 units.
496. **Proseminar in Speech and Hearing Science.** Required seminar for all graduate students; involves reporting of ongoing research of faculty, visiting researchers, and students. 0 units.
499. **Thesis Research.** Individual research in the various areas of speech and hearing science. 0 to 4 units (summer session, 0 to 2 units).

SPEECH COMMUNICATION

Head of Department: Professor R. E. Nebergall

Department Office: 244 Lincoln Hall, Urbana

101. **Principles of Effective Speaking.** Preparation and presentation of short informative and persuasive speeches; emphasis on the selection and organization of material, methods of securing interest and attention, and the elements of delivery. 3 hours.
102. **Introduction to Speech Communication.** Survey of the questions probed, the methods employed, and the current status of knowledge in the speech communication discipline; provides opportunities to understand the range of concerns and to explore specific areas of interest of the field. 4 hours.
105. **Voice and Articulation.** Same as Speech and Hearing Science 105. Basic factors of voice and speech sound production; analysis of faults that result in minor speech deviations or inadequacies; and individual analysis and guided practice toward improvement of speech habits. 2 hours.
107. **Parliamentary Procedure.** Principles and practice of parliamentary procedure. 2 hours.
111. **Verbal Communication.** Principles and practice in communication; stress on fundamentals of exposition in writing and speaking. The University rhetoric requirement is fulfilled by this course in conjunction with Speech 112. Credit is not given for both Speech Communication 111 and 101. 3 hours.
112. **Verbal Communication.** Theory and practice of communication; stress on deliberation and fundamentals of persuasion through speaking and writing. The University rhetoric requirement is fulfilled by this course. Credit is not granted for both Speech Communication 112 and 101. Prerequisite: Speech Communication 111. 3 hours.
113. **Group Discussion and Conference Leadership.** Study of leadership, group process, and interpersonal relations in the small group, conference, and the public forum; emphasis on practice in leading and participation in various types of public discussion and conference, with materials drawn from current public questions. Prerequisite: Sophomore

- standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours.
120. **Advanced Oral Communication.** Advanced principles of speech preparation and presentation; special problems and types of speeches; and considerable practice in composition and delivery of speeches. Prerequisite: Speech Communication 101 or equivalent. 3 hours.
 141. **Oral Interpretation.** Oral reading for understanding, appreciation, and communication. 3 hours.
 142. **Group Oral Interpretation of Literature.** Study of modern modes of group presentation of literature; emphasis on practice in script preparation, directing, and performance in chamber theatre and readers' theatre. Prerequisite: Speech Communication 141 or consent of instructor. 2 hours.
 157. **Elements of Stagecraft.** Same as Theatre 120. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
 161. **Fundamentals of Acting.** Same as Theatre 170. Study of the methods of acting, with emphasis given to basic techniques; the role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretation by means of voice and action. 3 hours.
 177. **The Arts of Public Discourse.** The nature and forms of practical and artistic public speech, including adaptations for the mass audience. 4 hours.
 178. **The Arts of the Theatre and Interpretative Speech.** The nature and forms of performing speech arts of theatre, interpretation, and film, including adaptations for the mass audience. 4 hours.
 198. **Freshman Seminar.** Survey of the role of the screen media in contemporary American culture; discussions, reports, and papers on topics of individual concern. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.
 199. **Undergraduate Open Seminar.** 0 to 9 hours.
 203. **Dramatics for Teachers.** Survey of methods and procedures of play production in the secondary school. 3 hours.
 204. **Speech for Teachers.** A course in teaching methods designed for prospective teachers who are non-speech communication majors; discussion of methods and materials available for teaching speech and directing extracurricular speech activities. 3 hours.
 207. **The Art of the Screen: Humor.** Study of selected comedies and other specimens of film and television humor in relation to theories of humor. Prerequisite: Consent of instructor. 3 hours.
 210. **The Rhetorical Tradition.** Survey of major trends in the development of rhetorical theory from Homer to the present. 3 hours.
 211. **Business and Professional Speaking.** Study, preparation, and presentation of the chief types of business speeches; special attention to conferences, sales talks, interviews, and job applications. Prerequisite: Speech Communication 101. 2 hours.
 213. **Persuasion and the Arts.** Introduction to the study of narrative films, theatre, fiction, and poetry as vehicles of indirect and overt persuasion. 3 hours.
 221. **Persuasion.** Study of the processes of motivation as applied to speeches intended to influence group opinion and action; practice in the preparation and delivery of short persuasive speeches. Prerequisite: Speech Communication 101; junior standing. 3 hours.
 223. **Argumentation: Theory and Practice.** Study of the theory of argument, e.g., evidence, reasoning, and construction of briefs; practice in formal and informal forms of debate and public discourse on current public questions. Prerequisite: Speech Communication 101; sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours.
 230. **Interpersonal Communication.** Study of communication theory and its application to interpersonal relations; extensive discussion of problems of conflict and misunderstanding in personal affairs to facilitate the development of knowledge, insights, and skills in

the processes of face-to-face interaction. Prerequisite: Speech Communication 101 and sophomore standing; by permission of the head of the department, the prerequisite may be waived for superior students, including James Scholars. 3 hours.

243. **The Oral Interpretation of Shakespeare.** Analysis and oral presentation of selections from Shakespeare's plays. Prerequisite: Junior standing; Speech Communication 141. 2 hours.
247. **Teaching of Speech.** Same as Secondary Education 247. Study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.
252. **The Rhetoric of Dissent.** A study of the rhetorical strategies and tactics employed in selected cases of dissent in American political and social life. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
253. **Case Studies in Public Discourse.** Detailed examination of selected cases of significant public discourse. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
254. **Freedom of Speech and the Ethics of Speech Communication.** Examination of the nature and variety of responses to value questions concerning communication; includes a survey of the evolution of and current controversies in freedom of speech. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
255. **Directing, I.** Same as Theatre 281. Problems of script selection and interpretation, casting, rehearsing, and performances; techniques of composition, movement, and business for the proscenium stage; and direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Radio and Television 280, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.
291. **Honors Course.** Individual study leading either to a thesis or to a comprehensive examination for honors in the Department of Speech Communication. Prerequisite: Senior standing; a grade-point average of 4.0 or consent of head of department. 2 hours. May be repeated for a maximum of 4 hours.
293. **Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of speech communication; grade-point average of 3.75; consent of head of department. 2 hours. May be repeated for a maximum of 4 hours.
301. **General Phonetics.** Same as Speech and Hearing Science 301. Basic principles of phonetic study, including observation and representation of pronunciation, ear training, and practice in transcription. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
307. **The Art of the Screen: Narration.** Same as Communications 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Communications 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Speech Communication 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
313. **Interpersonal Communication: Discussion and Interview.** Advanced study of theory, research, techniques, and training methods in interviewing and group discussion; em-

phasis on empirical research findings concerning communication processes in face-to-face groups. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.

315. **Greek, Roman, and Medieval Rhetorical Theory.** Same as Classical Civilization 315. Examination of the development of rhetorical theory, criticism, and pedagogy in Western thought; analysis of the contributions of major figures and works from Homer to the Renaissance. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ or 1 unit.
317. **Contemporary Rhetorical Theory.** Coverage of the major contributors to rhetorical theory from James and Winans to the present. 3 hours, or ½ or 1 unit.
319. **Russian and East European Cinema.** Same as Communications, Humanities, and Slavic 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian; no reading knowledge of Russian required, except for Department of Slavic Languages and Literatures majors. 3 hours or ¾ unit.
320. **Argumentation and Public Decision Making.** Study of the philosophical, logical, and psychological bases of public decision making through discussion and debate. Prerequisite: Speech Communication 223 or consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
321. **Theories of Persuasion.** Survey of theories of persuasion derived from rhetorical, philosophical, and psychological sources and their application to persuasive discourse. Prerequisite: Speech Communication 221 or graduate standing. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
322. **Renaissance and Modern Rhetorical Theory.** Significant movements in the development of rhetorical theory in England, France, and America from 1500 to the present. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
323. **Rhetorical Criticism.** Methods of interpreting and judging persuasive discourse with emphasis on political speaking and writing; lectures and practice in criticism. Prerequisite: Credit or concurrent registration in Speech Communication 322 or 350. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
324. **Persuasion in the Campaign and Movement.** Consideration of factors central to the sustained persuasive campaign or movement; special attention to the nature and functions of persuasion in the political campaign. Prerequisite: Speech Communication 221 or 321, or consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
335. **Interpersonal Communication Processes.** Same as Communications 335. Study of the major processes involved in an individual's adjustment to the communication situations of everyday life; emphasis on the development of interpersonal competency and orientations, social perception, interpersonal sentiment and hostility, trust, and the social context as factors influencing the understanding and evaluation of interpersonal messages. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
342. **Oral Interpretation of Poetry.** Analysis and oral presentation of literature representative of various poetic forms. Prerequisite: Speech Communication 141. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
344. **Criticism of the Oral Interpretation of Literature.** Examination of theories of aesthetics and practical criticism and their application to the criticism of specific examples of the oral performance of literature. Prerequisite: Speech Communication 141 or graduate standing, or consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.
345. **Contemporary Approaches to Oral Interpretation.** Modern concepts underlying the relationship of interpretation to the reader's experience of literature; discussions, reports, and oral interpretations of prose forms (including chamber theatre and readers' theatre). Prerequisite: Speech Communication 141 or consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.

346. **Introduction to the Methodology of Myth and Folklore.** Same as Comparative Literature, German, and Slavic 394, and English 387. Prerequisite: One year of college literature or consent of instructor. 3 hours or 1 unit.
350. **Selected Topics in the History and Criticism of Public Discourse.** Study of selected periods and genres of public discourse in historical context, including British, American, French, Russian, German, Chinese, and Japanese. Prerequisite: One course in rhetorical criticism or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. Additional work required for 1 unit credit. May be repeated with different context to a maximum of 12 hours or 4 units.
352. **Introduction to Modern Theatre Art.** Same as Theatre 352. Origins and development of modern theatrical production; critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
353. **Criticism of Contemporary Public Discourse.** Rhetorical criticism of selected aspects of contemporary public communication. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
361. **History of the European Theatre to the Renaissance.** Same as Theatre 361. The theatre and the theatre arts of ancient and medieval Europe. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
362. **History of the European Theatre from the Renaissance to 1900.** Same as Theatre 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
363. **Advanced Dramatic Writing.** Same as Radio and Television 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Speech Communication 263 or Theatre 280; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit. May be repeated for a maximum of 6 hours or 2 units.
366. **Development of the American Theatre.** Same as Theatre 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
374. **Introduction to Empirical Research Methods in Speech Communication.** Introduction to descriptive and experimental methods in speech communication; intended to produce understanding and critical evaluation of research designs. 3 hours, or $\frac{1}{2}$ or 1 unit.
375. **Speech Science, I.** Same as Linguistics 375 and Speech and Hearing Science 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms and to fundamental acoustics of speech. Prerequisite: Speech and Hearing Science 109 or 301, or Speech Communication 301, or consent of instructor. 4 hours or 1 unit.
376. **Speech Science, II.** Same as Linguistics 376 and Speech and Hearing Science 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Speech and Hearing Science 375. 4 hours or 1 unit.
377. **The Bases of Speech and Hearing Science.** Same as Speech and Hearing Science 377. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, the acoustical characteristics of speech, and the hearing of speech. Not open to students with credit in Speech Communication 375 or 376. Prerequisite: Speech and Hearing Science 109 or equivalent; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
383. **Development of Spoken Language.** Same as Speech and Hearing Science 383. Study of the correlates of language development from the prelinguistic period to adulthood.

Prerequisite: Senior standing; consent of instructor. 3 hours, or ½ or 1 unit. Additional work required for 1 unit credit.

400. **Seminar in Dramatic Form and Structure.** Same as Theatre 400. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Speech Communication 361 and 362, or equivalent; consent of instructor. 1 unit.
403. **Seminar for Teachers of Speech.** Investigation of current principles, materials, and developments in the field of speech communication and of their relationship to the teacher. 1 unit.
417. **Contemporary Viewpoints in Speech Communication Theory.** Same as Communications 417. A readings seminar comparing the principal approaches to communication and rhetorical theory in the twentieth century along with a consideration of their philosophical assumptions. 1 unit.
429. **Seminar in Speech Communication.** Special topics in speech communication. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 4 units.
430. **Contemporary Theories of Oral Communication.** Systematic study of speech making and discussion as related to contemporary views of communication; examination of the theoretical literature and experimental evidence. Prerequisite: Consent of instructor. 1 unit.
436. **Seminar in Theories and Procedures of Discussion.** Intensive examination of selected problems of communication in small, task-oriented groups; evaluation of special instrumental forms, such as the unstructured group, the work group, the panel, and the lecture-forum; critical analysis of recent research in group communication as a means of making decisions and of changing attitudes and behavior. Prerequisite: Speech Communication 313 or equivalent. 1 unit.
437. **The Analysis of Interpersonal Interaction.** Same as Communications 437. Exploration of theory, methodology, and empirical findings of descriptive and experimental approaches to the analysis of verbal and nonverbal interaction processes, in both laboratory and naturalistic settings. Prerequisite: Speech Communication 335 or consent of instructor. 1 unit.
438. **Seminar in Rhetorical Theory.** Study of special topics in the history of rhetorical theory. 1 unit. May be repeated for a maximum of 4 units.
441. **Historical Background of Oral Interpretation.** Historical survey of British and American theories of interpretation. 1 unit.
442. **Seminar in Oral Interpretation.** Investigation of basic problems in the history, nature, and function of oral interpretation. Prerequisite: Speech Communication 441; consent of instructor. 1 unit.
443. **Seminar in the Oral Interpretation of Individual Literary Styles.** Examination of the literary style of an individual writer or selected writers, through research, discussion, and oral readings; subject announced each semester. 1 unit. May be repeated with a change in content to a maximum of 4 units.
451. **Problems in Play Directing in the Educational Theatre.** Same as Theatre 451. Study of the audience, play selection, the actor's abilities and needs, tryouts and casting, conduct of rehearsals and methods of directing, the dramatic club, contests, and festivals. 1 unit.
452. **Problems in Play Production in the Educational Theatre.** Same as Theatre 452. Study of the school auditoria and stages, stage machinery and equipment and their use, lighting facilities and their use, organization of backstage crews, scene shifting and stage management, and production problems of special types of plays. 1 unit.
463. **Seminar in the History of Acting.** Same as Theatre 463. Studies in the history and theory of the art of acting. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units. Offered in 1975-76 and in alternate years.
465. **Seminar in Theatre Art.** Same as Theatre 465. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit.

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466. **The American Theatre Since 1900.** Same as Theatre 466. Major developments in acting, production, playwriting, organization, and operation. Prerequisite: Consent of instructor. 1 unit.
468. **Seminar in Theatre History.** Same as Theatre 468. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
469. **Seminar in the Stage History of Classic English Plays.** Same as Theatre 469 and English 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit.
474. **Experimental Design in Speech Communication Research.** Detailed treatment of major issues and options in designs employed in speech communication research. Prerequisite: Speech Communication 374 or equivalent; introductory statistics course. $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
495. **Special Problems.** Individual investigation of special projects not included in theses. Prerequisite: Consent of head of department. $\frac{1}{2}$ to 2 units. Open to master's candidates for a maximum of 1 unit, and to doctoral candidates for 1 or 2 units.
499. **Thesis Research.** 0 to 4 units.

SWAHILI

(See Linguistics)

THEATRE

Chairman of Department: Professor B. W. Hewitt

Department Office: 4-122 Krannert Center for the Performing Arts, Urbana

100. **Practicum, I.** Laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting, sound properties, costumes, and makeup for public performance. Prerequisite: Consent of instructor for nontheatre majors. 1 to 3 hours. May be repeated for three semesters.
101. **Theatre: Modern Forms.** Introduction to theatre aesthetics, to theatre as a profession, and to the theatre plant; study of dramatic form and structure with emphasis on realism, naturalism, and their modifications; and a survey of theatre history from 1850 to World War II. 4 hours.
102. **Theatre: Contemporary Forms.** Study of revolts against realism; includes symbolism and its theatre, theories of Appia and Craig, expressionist drama and its staging, Brecht and epic theatre, theatre of the absurd and later developments, and the musical play. Prerequisite: Theatre 101. 3 hours.
103. **Theatre: Classical and Medieval Forms.** Theatre architecture, drama, and play production practices of ancient Greece and Rome, of Asia, and of Britain and the continent during the Middle Ages. Prerequisite: Theatre 101. 3 hours.
104. **Theatre: Sixteenth- and Seventeenth-Century Forms.** Survey of theatre history and drama with emphasis on Baroque Spain, Elizabethan England, and Renaissance Italy. Prerequisite: Theatre 101. 3 hours.
105. **Theatre: Seventeenth- and Eighteenth-Century Forms.** Survey of theatre history and drama with emphasis on France of the neoclassical era, England of the Restoration, and Europe and America of the Georgian period. Prerequisite: Theatre 101. 3 hours.

111. **Materials and Processes: Textiles.** Study of fibers, weaving methods, and color application; laboratory projects used to demonstrate textiles' response to cutting, draping, and suitability for stage scenery, properties, and costumes. 2 hours.
112. **Materials and Processes: Woods and Metals.** Study of the properties, availability, and costs of the woods and metals most useful for the theatre; laboratory experience in cutting, jointing, shaping, and finishing. 2 hours.
113. **Materials and Processes: Papers and Plastics.** Exploration of the potential use for a broad range of papers and plastics in the construction of stage properties, decoration, and accessories. 2 hours.
120. **Elements of Stagecraft.** Same as Speech Communication 157. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting; and lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
121. **Scenecraft.** Introduction to theatre shop organization, tools, and materials; basic scenery construction, painting, and assembling. Open to students in the College of Fine and Applied Arts only. 2 hours.
131. **Stage Lighting and Sound Effects.** The history and development of stage lighting; the theory and function of stage lighting and sound; examination of instruments, equipment, and installations; and planning the design of stage lighting and sound. Lectures, practical problems, and laboratory. 3 hours.
140. **Costume Construction.** Theory and practical techniques of sewing, fitting, and decorating stage costumes analyzed and applied to specific production situations; laboratory practice culminating in construction of a period costume by each student. 2 hours.
141. **Makeup for the Theatre, I.** Principles, materials, equipment, and application techniques; corrective and age effects; and delineation of character through use of paint and hair goods. Lecture, discussion, and practice. 2 hours.
142. **Makeup for the Theatre, II.** Equipment and methods for creation of three-dimensional effects through use of putty, wax, adhesives, and rubber; techniques of design and execution of masks, national types, and nonrealistic styles. Lecture, demonstration, and practice. Prerequisite: Theatre 141. 2 hours.
170. **Fundamentals of Acting.** Same as Speech Communication 161. Study of the methods of acting, with emphasis given to the basic stage techniques; the role of the character in relation to the play as a whole; and the intellectual and emotional values of the play and their interpretations by means of voice and action. 3 hours.
171. **Speech for the Stage: Fundamentals.** Study of the physical and psychological bases of speech and the analysis and synthesis of speech sounds; training in the requirements of good voice in the theatre; projection through breath control, support of tone, resonance, voice placement, articulation, and the element of tone; and exercises in elimination of speech regionalisms. 2 hours.
172. **Speech for the Stage: Dialogue.** Examination of the dialogue in modern plays, primarily British and American; analysis of its construction, characteristics, thought, and emotion; making meaning clear through phrasing; and attainment of vitality and variety. Class practice and performance. Prerequisite: Theatre 171. 2 hours.
173. **Speech for the Stage: Dialects.** Analysis of British stage speech and the important departures from it and of the major dialects in the United States; their phonetic transcription; training in perception; and the use of dialects in plays. Exercises and practice. Prerequisite: Theatre 172. 2 hours.
174. **Movement for the Stage: Improvisation.** Purposes and history; exercises in developing the sense memories and in their pantomimic recall; exercises to heighten the actor's observations, imagination, and creative powers; and characterized pantomime, both improvised and based on characters in plays. 2 hours.
175. **Movement for the Stage: Techniques.** Uses of movement in acting; physiological and psychological bases of movement; analysis and synthesis of the body's movement; movement timing, spacing, force, quality, climax, and motivation; stage conventions in movement; and movement and character. Exercises and drill. Prerequisite: Theatre 174. 2 hours.

176. **Acting: Characterization.** The psychology of acting; methods of preparing a role. Prerequisite: Theatre 175. 3 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
220. **Advanced Scenecraft.** The examination of stage equipment, including rigging systems, revolves and wagon systems, platforming, and methods of shifting stage scenery. Prerequisite: Theatre 121. 2 hours.
221. **Advanced Scenery Painting.** Studio course in the problems of painting stage scenery, with special emphasis on contemporary materials and rendering processes. Prerequisite: Theatre 220 or consent of instructor. 2 hours.
222. **Scene Design, I.** Introduction to the basic processes of designing for the stage, including physical considerations, relevant research for design, stage perspective, and specific design projects for proscenium and open stage forms. Prerequisites: Theatre 120 and 121, or consent of instructor. 3 hours.
231. **Stage Lighting Design.** A studio course analyzing current lighting practices by means of production-oriented projects. Prerequisite: Theatre 131. 3 hours.
241. **Costume Design.** Application of design elements to creation and analysis of costume designs; evaluation of sketches on the basis of aesthetic and practical criteria; and emphasis on function of costume as an element in unified production. Prerequisite: Theatre 140 or consent of instructor. 3 hours.
242. **Costume Accessories.** Materials and methods for fabricating and renovating period costume accessories; analysis in terms of cost, labor, and effectiveness on stage; and laboratory projects for development of skills in handling materials and processes. Projects to include construction of armor, jewelry, wigs, and small properties. Prerequisite: Theatre 140. 2 hours.
263. **Theatre of the Black Experience.** An aesthetic approach to the study of Afro-American drama concerned with the principles, playwrights, movements, and media of black drama since 1960. Prerequisite: Consent of instructor. 3 hours.
271. **Acting: Studio, I.** Periodic performances of soliloquies and short scenes from plays written after World War I; presentation before members of the theatre faculty and invited guests. Prerequisite: Second-semester junior standing in the acting option or consent of the theatre faculty. 3 hours.
272. **Acting: Styles for Period Plays.** Acting in important theatrical periods: classical Greece, the commedia dell'arte of Italy, Elizabethan England, the Carolinian Restoration, seventeenth-century France, and nineteenth-century Europe and America; the effect on acting of the theatre's physical aspects; and class performance of scenes. Prerequisite: Theatre 170 or 176. 3 hours.
280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Speech Communication 263, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.
281. **Directing, I.** Same as Speech Communication 255. Problems of script selection and interpretation, casting, rehearsing, and performances; techniques of composition, movement, and business for the proscenium stage; and direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
291. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
292. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
300. **Practicum, II.** Advanced laboratory in acting, directing, playwriting, and theatre management; the design, construction, and handling of scenery, lighting sound, properties, costumes, and makeup for public performance. Prerequisite: For nontheatre majors, consent of instructor. 1 to 3 hours, or $\frac{1}{4}$ to $\frac{1}{2}$ unit. May be repeated to a total of 12 hours or 2 units.

310. **Theatre Planning and Programming.** Theatre programming including consideration of relationships of audience to stage, the merits of the various stage technological systems, and the related business, audience, and production facilities of a theatre center. 2 hours or $\frac{1}{2}$ unit.
320. **Scene Design, II.** Studio course with design projects for period plays, the musical theatre, and contemporary forms. Prerequisite: Theatre 222 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
330. **Photo-Projection Techniques.** Integration of film techniques with the scenic environment for modern staging, including initial rendering, film processing, projection surfaces, and stage projection equipment. Prerequisite: Theatre 131. 2 hours or $\frac{1}{2}$ unit.
352. **Introduction to Modern Theatre Art.** Same as Speech Communication 352. Origins and development of modern theatrical production; a critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Creative Dramatics for Children.** Study of the subject matter and techniques of creative dramatics for children with laboratory application. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Theatre for the Child Audience.** Study of the history, objectives, and techniques of play production for the child audience; laboratory application. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Musical Theatre.** Same as Music 355. Study of musical theatre and its scores and librettos; consideration of production problems, including those of choreography, scenery, and costume design; and the planning and production of a musical play or score. Prerequisite: Junior standing and consent of instructor. 3 hours or $\frac{1}{2}$ unit.
361. **History of the European Theatre to the Renaissance.** Same as Speech Communication 361. The theatre and the theatre arts of ancient and medieval Europe. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
362. **History of the European Theatre from the Renaissance to 1900.** Same as Speech Communication 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
366. **Development of the American Theatre.** Same as Speech Communication 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
368. **History of Theatre Costume.** Survey of the history of costumes worn on the stage from the classical Greek period to the present. Prerequisite: Theatre 361 and 362, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
371. **Acting: Studio, II.** Public presentation of short scenes under semiproduction conditions: basic lighting, stock costumes, and minimal properties. Prerequisite: Second semester senior standing in the acting option, or consent of theatre faculty. 3 hours or $\frac{1}{2}$ unit.
372. **Acting: Theories.** Summary of acting theories prior to the nineteenth century; intensive examination of philosophies, theories, and principles promulgated by teachers, playwrights, critics, and actors, ranging from Delsarte and the early romanticists, realists and naturalists, to the present-day absurdists. 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Advanced Dramatic Writing.** Same as Radio and Television 363 and Speech Communication 363. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Theatre 280; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a total of 6 hours or 2 units.
381. **Directing, II.** Production problems and techniques of movement and business for non-proscenium staging areas; direction of appropriate scenes for class presentation; and study of production practices for the musical play. Prerequisite: Theatre 281. 3 hours or $\frac{1}{2}$ unit.

- 400. Seminar in Dramatic Form and Structure.** Same as Speech Communication 400. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Theatre 361 and 362, or equivalent; consent of instructor. 1 unit.
- 451. Problems in Play Directing in the Educational Theatre.** Same as Speech Communication 451. Study of the audience, play selection, the actor's abilities and needs, tryouts and casting, conduct of rehearsals and methods of directing, the dramatic club, and contests and festivals. 1 unit.
- 452. Problems in Play Production in the Educational Theatre.** Same as Speech Communication 452. Study of the school auditoria and stages; stage machinery and equipment and their use; lighting facilities and their use; organization of backstage crews; scene shifting and stage management; and production problems of special types of plays. 1 unit.
- 463. Seminar in the History of Acting.** Same as Speech Communication 463. Studies in the history and theory of the art of acting. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units. Offered in 1975-76 and in alternate years.
- 465. Seminar in Theatre Art.** Same as Speech Communication 465. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit.
- 466. The American Theatre Since 1900.** Same as Speech Communication 466. Major developments in acting, production, playwriting, organization, and operation. Prerequisite: Consent of instructor. 1 unit.
- 468. Seminar in Theatre History.** Same as Speech Communication 468. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit.
- 469. Seminar in the Stage History of Classic English Plays.** Same as Speech Communication 469 and English 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit.
- 491. Special Problems.** Individual research in selected topics by arrangement with the instructor. $\frac{1}{2}$ to 2 units.
- 499. Thesis Research.** 0 to 2 units.

THEORETICAL AND APPLIED MECHANICS

Head of Department: Professor R. T. Shield

Department Office: 212 Talbot Laboratory, Urbana

- 150. Analytical Mechanics (Statics).** Resultants of force systems; algebraic and graphical conditions of equilibrium of force systems; analysis of forces acting on members of trusses, frames, etc.; forces due to friction; and centroids. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 2 hours.
- 152. Engineering Mechanics, I (Statics).** Analysis of force systems by means of vector algebra; treatment of two- and three-dimensional systems, including force fields; and introduction of the principle of virtual work. Prerequisite: Physics 106; concurrent registration in Mathematics 140, 141, or 145. 3 hours.
- 154. Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 212 with less emphasis on some topics. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 4 hours.
- 156. Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 212. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 5 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.

212. **Engineering Mechanics, II (Dynamics).** Introduces the elements of vector calculus as applied to mechanics; treats the kinematics of three-dimensional motion of a particle and of a rigid body; considers motion relative to translating and rotating reference frames; and treats the kinetics of particles and rigid bodies by using principles involving force, mass, and acceleration, work and energy, and impulse and momentum. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
221. **Elementary Mechanics of Deformable Bodies.** Elastic and inelastic relationships between external forces (loads) acting on deformable bodies and the stresses and deformations produced; tension and compression members; members subjected to torsion and to bending; buckling (columns); combined stresses; repeated loads (fatigue); energy loads and impact; and influence of properties of materials. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
223. **Mechanical Behavior of Solids.** Influence of loading conditions and environment on the behavior of engineering materials; effects of rate of loading, time, temperature, number of stress cycles, and state of stress on the ductile and brittle behavior of materials; and significance of mechanical properties. Prerequisite: Concurrent registration in Theoretical and Applied Mechanics 221. 1 hour.
224. **Behavior of Materials.** Introduction to atomic and molecular structure of metals, cement, concrete, plastics, ceramics, and glass; response of these materials to rapid, steady, and repeated loads at various temperatures (and environments) in terms of rheological models; and fracture behavior of specific materials, that is, stress rupture, brittle fracture, and fatigue of metals and concrete. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
235. **Fluid Mechanics.** Fluid properties and statics; fluid flow; ideal and real fluids; similarities; laminar and turbulent flow in closed conduits; boundary layers; free surface flow; and turbo-machinery. Prerequisite: Theoretical and Applied Mechanics 212. 4 hours.
293. **Senior Research Project.** Students work briefly in each of the several areas of modern research in theoretical and applied mechanics. After selecting one area for further study, each student prepares a proposal for a research project which will be carried out in Theoretical and Applied Mechanics 294. Prerequisite: Senior standing in engineering mechanics. 2 hours.
294. **Senior Research Project.** Individual projects conducted in the field of mechanics previously selected in Theoretical and Applied Mechanics 293. Each student prepares a technical report or paper and presents the results orally. The best papers are presented at a symposium held at the end of the semester and are bound together and published as a theoretical and applied mechanics report. Prerequisite: Theoretical and Applied Mechanics 293. 4 hours.
299. **Thesis.** Thesis investigation of special subjects including theoretical and/or experimental research. Prerequisite: Senior standing; approval of head of department. 3 hours.
311. **Mechanical Vibrations.** Kinematics of vibratory motion; comprehensive study of motion having single degree of freedom; critical speeds of shafts; vibration of systems with several degrees of freedom; and applications to engineering problems. Credit is not given for both Theoretical and Applied Mechanics 311 and Civil Engineering 374. Prerequisite: Theoretical and Applied Mechanics 154, 156, or 212, and 221. 3 hours, or $\frac{1}{2}$ to 1 unit.
314. **Advanced Dynamics for Engineers.** Three-dimensional kinematics of a rigid body; general dynamics of a rigid body; moments and products of inertia; kinetic energy; rotation of a rigid body about a fixed axis and about a fixed point; Euler equations of motion; gyroscopic theory; introduction to Lagrange equations; and engineering applications. Prerequisite: Theoretical and Applied Mechanics 212 or equivalent; Mathematics 341 or 345. 3 hours or 1 unit.
321. **Advanced Mechanics of Deformable Bodies.** Basic concepts of mechanics of deformable bodies and brief review of elementary topics; theory of stress and strain at a point;

theories of failure, including failure by fracture; unsymmetrical bending; curved beams; torsion of noncircular sections; energy principles; and Castigliano's theorem. Prerequisite: Theoretical and Applied Mechanics 221, and 223 or 224. 3 hours, or $\frac{1}{2}$ to 1 unit.

324. **Flow and Fracture of Structural Metals.** Fundamental concept of strength of crystalline engineering materials at atomic, single crystal, and polycrystalline levels of association in relation to engineering mechanisms of failure; functional relationship between material variables, state of stress, strain, time, temperature, and failure of engineering components by creep, stress rupture fatigue, and brittle fracture. Prerequisite: Theoretical and Applied Mechanics 221 and 224, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Experimental Stress Analysis.** Measurement of stresses or deformations that are of significance in the engineering design of load resisting members; use of optical, electrical, and mechanical instrumentation, models, analogies, brittle coatings, electrical resistance gauges, photoelasticity, etc. Prerequisite: Theoretical and Applied Mechanics 221 or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
334. **Fluid Mechanics and Advanced Hydraulics.** Study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels; viscosimetry; dimensional analysis; effects of boundary conditions; cavitation; water tunnel; hydraulic jump; water hammer pumps; and turbines. Some laboratory work. Prerequisite: Theoretical and Applied Mechanic 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Dynamics of Fluids.** An intermediate course in the mechanics of fluids introducing analytical methods of solution for ideal and real fluids; potential flow theory, theoretical approaches to viscous flows including boundary layer theory, and the analysis of compressible flows are indicated. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
346. **Dimensional Analysis and Theory of Models.** The nature and use of dimensions; systematic calculations and dimensionless products; algebraic theory of dimensional analysis; similarity and model laws; and derivation of model laws from differential equations. Applications include von Karman's theory of similarity in turbulent flow, boundary layer theory, topics in open channel flow, model laws for pumps and turbines, topics in structural analysis and vibration theory, and topics in the theory of heat. 3 hours, or $\frac{1}{2}$ or 1 unit.
351. **Fundamental Concepts of Deformable Body Mechanics.** Introduction to the general theories of kinematics of deformable bodies; general balance laws applicable to continuum mechanics; constitutive relations (stress-strain relations); and introductions to linear elasticity, linear viscoelasticity, and special concepts in other areas of solid mechanics and fluids. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343 and 345. 3 hours or 1 unit.
360. **Continuum Mechanics, I.** A unified treatment of modern continuum mechanics; linear algebra and analysis, review of kinematics and general balance laws, and general theory of mechanical constitutive equations (simple materials). Prerequisite: Theoretical and Applied Mechanics 351 or equivalent. 3 hours or 1 unit.
373. **Engineering Acoustics.** Same as Electrical Engineering 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems; vibrating string; vibrating membrane; plane waves; spherical waves; vibrating piston; acoustical filters; loudspeakers and microphones; principle of reciprocity; the ear; and architectural acoustics. Students may not receive credit for both Theoretical and Applied Mechanics 373 and Electrical Engineering 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
381. **Mechanical Behavior and Fracture of Noncrystalline Solid Engineering Materials.** Characterization of noncrystalline materials including inorganic glasses, polymers, clay, cement, asphalt, particulate composites, and fibrous composites according to their molecular or microscopic structure and macroscopic mechanical behavior; examination of models of structure that relate to mechanical behavior; treatment of time-

dependent behavior using rheological models; discussion of ductile and brittle modes of fracture; and introduction of concepts of fracture mechanics and the statistical theory of fracture strength used to describe fracture strength. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.

392. **Analysis and Synthesis of Problems.** Emphasis on the rational analysis of comprehensive problems and engineering systems. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
393. **Independent Study.** Individual studies in any area of theoretical and applied mechanics. 1 to 8 hours, or $\frac{1}{4}$ to 2 units.
400. **Seminar in Engineering Mechanics.** Treatment of special topics in the field of mechanics including mechanics of solids problems such as fracture of metals and creep of materials; fluid flow problems such as the nature of turbulence, boundary layer theory, nature and effects of roughness of boundary, and effects of free surface; dynamics problems such as vibration of beams with moving loads and the gyroscope; and certain other topics, such as biomechanics, that cut across all areas of mechanics. Each semester one or more of these topics is selected and announced as the area to be covered. 0 to $\frac{1}{4}$ unit.
412. **Vibration Analysis.** Continuation of Theoretical and Applied Mechanics 311. Specific topics include systems of several degrees of freedom; applications of generalized coordinates and Lagrange's equations; boundary value problems in vibration of elastic bodies, including strings, rods, and beams; Stodola's method; iteration process and matrix procedure; vibrations in reciprocating machines; airplane structures and propellers; impact and transient vibrations; self-excited vibration; stability; and nonlinear systems. Prerequisite: Theoretical and Applied Mechanics 311 or equivalent. 1 unit.
416. **Energy Principles in Engineering Mechanics.** Introduction to the variational principles of mechanics and their applications to engineering problems; the derivation, interpretation, and applications of the principle of virtual displacements, the principle of minimum potential energy, and the principle of complementary energy; major emphasis on Castigliano's theorem, Hamilton's principle, and Lagrange's equations of motion; brief treatment of variational methods of approximation; and numerous illustrative applications to stress analysis of statically determinate and statically indeterminate frames, problems of elastic stability, the theories of rings and curved beams, the theory of elastic plates, vibrations of structures, and wave motions. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
417. **Stochastic Structural Dynamics.** Same as Aeronautical and Astronautical Engineering 452. Structural dynamics problems treated from a probabilistic point of view; introduction of theory of probability and random processes as mathematical tools; study of response of structures under random excitation in the order of increasing complexity; and discussion of probability of failure for such structures. Prerequisite: Aeronautical and Astronautical Engineering 355 or Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
418. **Aerodynamic Noise.** Same as Aeronautical and Astronautical Engineering 453. Mathematical techniques for the analysis of intensity, spectrum, and directivity of noise field in various environments; practical examples including jet and rocket engines, propeller and fan, sonic boom, and cabin noise of high-speed vehicles. Prerequisite: Graduate standing in engineering, physics, or mathematics. 1 unit.
424. **Properties of Engineering Materials.** Structure of metals and behavior of materials under various conditions of loading and use, including static, creep, fatigue, and impact; effects of high and low temperature, strain rate, state of stress, and internal structure; criteria of failure; relation of mechanical properties to behavior; significance of mechanical properties; tests and interpretation of test data; and material specifications. $\frac{1}{2}$ or 1 unit.
425. **Mechanics of Inelastic Bodies.** Presents methods of obtaining relations between loads, deformations, stresses, and strains in various members that are stressed beyond the elastic range; most applications consider both time-independent and time-dependent

- (creep) inelastic deformations; and specific topics include straight and curved beams, columns, and beam-columns, fully plastic analysis of statically indeterminate members and structures, torsion of circular and noncircular bars, and torsion-tension of bars of circular cross section. Prerequisite: Theoretical and Applied Mechanics 321. $\frac{1}{2}$ to 1 unit.
- 428. Analysis of Nonlinear Systems.** Same as Electrical Engineering 428. Treatment of singular points and stability considerations; consideration of graphical and analytical methods including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
- 429. Theory of Linear and Nonlinear Viscoelasticity.** Same as Aeronautical and Astronautical Engineering 429. Fundamental concepts of viscoelasticity with applications: elastic-viscoelastic analogies, creep and relaxation functions, thermomechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, and torsion of nonlinear bars and shells. Prerequisite: Theoretical and Applied Mechanics 351 or Aeronautical and Astronautical Engineering 326, or consent of instructor. 1 unit.
- 431. Theory of Ideal Fluid Flow.** Together with Theoretical and Applied Mechanics 432, covers topics in advanced fluid mechanics that are the basis of many modern developments. Ideal fluid theory is concerned with an incompressible fluid of negligible viscosity. The differential equations of motions are derived and the several methods of obtaining flow solutions are presented: the obtaining of velocity potentials and stream functions by superposition of the effects of source, doublets, and vortices, and by the methods of conformal mapping. Relations for finding the resultant forces and moments on bodies are derived and applied to bodies such as lifting surfaces. Other topics include the theory and application of free streamline flows, vortex motions, and surface wave theory. Prerequisite: An elementary course in fluid flow; a course in advanced calculus. 1 unit.
- 432. Theory of Flow of Viscous Fluids.** Although a logical continuation of Theoretical and Applied Mechanics 431, this course need not be taken sequentially. The theoretical development, analysis, and solution of incompressible viscous fluid flow problems; derivation of the differential equations of motion, starting with the stress relations occurring in viscous fluids; development of direct and approximate solutions for laminar flows; presentation of boundary-layer theory; introduction to the occurrence of turbulence and its characterization; the basic equations for analyzing turbulent flows; presentation of approximate solution for flows in boundary-layers with and without pressure gradients (and separation) pipes and jets; and consideration of experimental observation and application to technological problems. Prerequisite: An elementary course in fluid flow; a course in differential equations. 1 unit.
- 438. Turbulence.** Starting with the statistical modes of characterizing turbulence, discussion covers statistical theory, energy considerations, and nature of turbulence in typical flows. Laboratory experiments are used to illustrate hot wire technique of turbulence measurements and the structure of turbulence. Prerequisite: Theoretical and Applied Mechanics 432 or equivalent. 1 unit.
- 441. Applied Analysis in Engineering.** Provides training in applications of mathematics to engineering problems; most of the illustrations taken from engineering mechanics. Prerequisite: Mathematics 143; Mathematics 343 and 345 recommended. 1 unit.
- 442. Applied Analysis in Engineering.** Continuation of Theoretical and Applied Mechanics 441. Prerequisite: Mathematics 143; Mathematics 343 and 345 recommended. 1 unit.
- 451. Theory of Elasticity with Application to Engineering Problems.** Study of the mechanics of elastic deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain, and properties of materials; detailed study of relations between stress-

es, strains, and displacements; and special consideration given to their significance in engineering problems. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343; Mathematics 341 or equivalent. 1 unit.

452. **Theory of Elasticity with Application to Engineering Problems.** Continuation of Theoretical and Applied Mechanics 451. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
454. **Theory of Shells.** Provides the theoretical basis of stress analysis of shell-type structure, such as ships, submarines, monocoque aircraft structures, concrete roofs and domes, pressure vessels, and containers for liquids; includes the differential geometry of shell theory, equilibrium equations, momentless theory of shells, strains in shells, statically indeterminate problems of shells, energy formulations, and stability of shells. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
457. **Classical Elastostatics.** A modern unified treatment of the concepts and techniques developed by investigating the Cauchy-Navier equations; emphasis on the interpretation and motivation of ideas and their interrelation for the solution of three-dimensional problems; and topics including the classical boundary-value problems, existence and uniqueness theorems, stress functions and displacement potentials, singular states of stress, extension of Green's method to the equations of elasticity, method of series, and approximation techniques. The course represents a preparation for (1) students interested in the current state of knowledge in classical elasticity, and (2) students intending to do doctoral dissertations in classical elasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent; consent of instructor. 1 unit.
458. **Wave Motion in Continuous Media.** Analysis of the dynamics of deformable bodies with a major emphasis on elastic media; introduction to the terminology associated with and the methods of treating such problems; general discussion of the motion of strings, bars, shafts, plates, and other bodies when subjected to load; detailed examination of approximations involved; and discussion of their engineering significance. Prerequisite: Theoretical and Applied Mechanics 311, 314, and 451; Mathematics 341, 342, or 343, or equivalent. 1 unit.
460. **Continuum Mechanics, II.** Continuation of Theoretical and Applied Mechanics 360. Viscous fluids (without memory) and elastic bodies as examples of simple materials; general principles of continuum thermodynamics; thermodynamics of elastic bodies; and selected topics in modern continuum mechanics. Prerequisite: Theoretical and Applied Mechanics 360. 1 unit.
462. **Theory of Plasticity.** The physical and mathematical formulation of the mechanics of inelastically deformed bodies, plastic stress-strain laws, and their association with yield and loading function; deals primarily with members subjected to biaxial and triaxial stress conditions. Specific topics include applications to flexure and torsion of prismatic members; expansion of thick-walled cylinders and spherical shells; and introduction to problems in plane plastic flow and variational plasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent. $\frac{1}{2}$ or 1 unit.
464. **Theory of Buckling.** The pertinent information and theoretical background required for the prediction of failure by buckling of structures such as airplanes, ships, bridge trusses, fabricated towers, and shells; practical illustrations. Specific topics include elastic columns with various end restraints; buckling of framework, arches, rings, and plates; inelastic buckling of columns and plates; lateral buckling of beams; energy theory; Ritz procedure; and Euler's equation of the calculus of variations. Prerequisite: Theoretical and Applied Mechanics 416 and 451. $\frac{1}{2}$ or 1 unit.
467. **Thermomechanics of Nuclear Reactor Systems.** Same as Nuclear Engineering 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal-shock and thermal stress-wave propagation; and current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.

- 472. Advanced Photoelasticity.** Theoretical and practical aspects of modern photoelasticity; topics include three-dimensional photoelasticity, birefringent coatings, dynamic photoelasticity, photoplasticity, photoviscoelasticity, and photothermoelasticity. Prerequisite: Theoretical and Applied Mechanics 326 or 451, or consent of instructor. 1 unit.
- 485. Fracture Mechanics.** Acquaints students with the analytical and experimental techniques used to solve current fracture problems; topics include a discussion of the macroscopic theories used to determine the static strength of bodies containing cracks; linear elastic fracture mechanics (the tool and the model) and its relation to the Griffith criteria of fracture; elastic-plastic fracture mechanics models: small-scale yielding results and their implications; and an introduction to fracture mechanics in the realm of general yielding. Examples of how the analytical methods can be applied are derived from discussion of the general fracture control plan. Prerequisite: Theoretical and Applied Mechanics 324 and 451, or consent of instructor. 1 unit.
- 493. Advanced Independent Study (Special Problems).** Analytical or experimental studies in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, theory of plasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, fatigue of metals, etc. $\frac{1}{2}$ to 2 units.
- 499. Thesis Research.** 0 to 4 units.

UKRAINIAN

(See Slavic Languages and Literatures)

URBAN AND REGIONAL PLANNING

Head of Department: Professor M. P. Brooks

Department Office: 909 West Nevada Street, Urbana

- 171. Planning of Cities and Regions.** Survey of city and regional planning as related to problems and programs of urbanization and resource development. 3 hours.
- 199. Undergraduate Open Seminar.** 0 to 9 hours.
- 236. Planning Workshop, I.** Field work dealing with selected physical and/or social planning problems. Prerequisite: Consent of instructor. 5 hours.
- 240. Planning Internship.** Professionally supervised field experience in public and private planning or development agencies; designed to introduce students to professional employment and actual planning practice. The student works in a University-approved agency of his own choice either during the summer session between his junior and senior years or part-time during a regular semester. Summary reports are submitted by both employer and student. Prerequisite: Senior standing or consent of instructor. 2 to 6 hours. No more than 8 hours of Urban Planning 240 and 340 may be applied toward the Bachelor of Urban Planning degree.
- 260. Special Problems.** Special projects, research, and independent reading. Prerequisite: Consent of head of department. 2 to 6 hours.
- 337. Planning Workshop, II.** Small-group field work dealing with actual planning problems at local, regional, state, or national levels; emphasis on problem analysis and generation of alternatives. Student selects from several sections, depending on specific interests. Prerequisite: Urban Planning 236 or consent of instructor. 6 hours or $\frac{3}{4}$ unit.
- 338. Planning Workshop, III.** Small-group field work dealing with actual planning problems at local, regional, state, or national levels; emphasis on production of concrete plans and policies, including strategies for implementation. Student selects from several

sections, depending on specific interests. Prerequisite: Urban Planning 337 or consent of instructor. 6 hours or $\frac{3}{4}$ unit.

340. **Advocacy Planning Field Work.** The student is assigned as an observer and participant to work directly with disadvantaged persons or groups, usually through community advocacy agencies, human relations commissions, or comparable mechanisms. The student as advocate planner is responsible to the clients he serves, with faculty constituting resource groups. Opportunities may be limited to insure continuity of service; evaluation reports required. Prerequisite: Senior standing or consent of instructor. 2 to 6 hours, or $\frac{1}{2}$ to 1 $\frac{1}{2}$ units. No more than 8 hours of Urban Planning 340 and 240 may be applied toward the Bachelor of Urban Planning degree; no more than 2 units of Urban Planning 340 and/or 440 may be applied toward the Master of Urban Planning degree, and these must be in addition to other minima required by the Graduate College and the Department of Urban and Regional Planning.
348. **Air Pollution Seminar.** Same as Agricultural Engineering, Civil Engineering, General Engineering, Geography, Mechanical Engineering, and Veterinary Medical Science 348. An interdisciplinary seminar on air pollution, including such topics as the health effects and economic damage of air pollution, and political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. 2 hours or $\frac{1}{2}$ unit.
351. **History of Planning in the United States.** Planning from the mid-nineteenth century to the present as related to cultural, societal, and philosophical influences. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
360. **Introduction to Social Planning.** Survey of the major social policy issues confronting urban areas in the United States today; examination of problems, policies, and programs in several functional areas (education, manpower development, health, welfare, etc.), as well as their interrelationships and their respective contributions to the problems of poverty; and analysis of processes of citizen participation as well as the roles of government in general and the planner in particular. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
373. **Urban Structure and Functions.** The concept of urban structure; the elements of urban spatial structure and growth; the human stresses in urban spatial structure; and structural remedies past and present. Primarily for first-year graduates in urban planning. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
374. **Urban Planning Theory.** Examination of the urban planning function within a theoretical, methodological, institutional, and professional context. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
376. **Planning Analysis.** Research and analytic techniques in urban planning: economic base and employment; population; market analysis; and derivation and use of statistical data. Prerequisite: Urban Planning 171 or consent of instructor. 4 hours or $\frac{3}{4}$ unit.
377. **Comprehensive Planning Procedure.** Plans, the planning process, and implementation procedures for physical, social, and economic development planning; professional roles and planning functions in urban and regional comprehensive planning. Prerequisite: Consent of instructor. 4 hours or $\frac{3}{4}$ unit.
378. **Law and Planning Implementation.** Cases, legislation, and materials illustrative of the social, economic, and environmental interrelationships of land-use planning and the dynamic role of law as a system of controlled conflict; traditional and emerging concepts of zoning, subdivision regulation, housing codes, and review procedures. Prerequisite: Political Science 150 and 151, or 305 and 306, or Urban Planning 379, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
379. **Legal Basis of Governmental Planning.** Cases and materials illustrative of legal concepts and institutions basic to the governmental planning process including property, police power, eminent domain, taxation, separation of powers, and due process; indicates both the problems and potential of adaptability by the legal system in response to contemporary socioenvironmental issues. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.

380. **Survey of Regional Planning.** Concepts and procedures for planning of regions; river valley, metropolitan, state, and national planning. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
384. **Urban Design and Planning Methods.** Concepts and techniques of urban analysis, plan making, and implementation essential for effective interdisciplinary work in urban design; case studies of major types of large-scale projects. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
386. **Seminar on Environmental Policy and Law.** Identification and analysis of environmental issues and legal developments primarily at the state and federal levels. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
437. **Synthesis.** Simulation of a real-world planning system. Students work individually or in teams on planning problems at local, regional, state, or national levels. Emphasis is on interaction of actors and institutions involved in the planning process. Discussion sessions focus on synthesis of the knowledge and skills acquired in other courses, as applied to actual planning practice. Prerequisite: Urban Planning 337 and 338, or consent of instructor. 1 $\frac{1}{2}$ units.
440. **Professional Internship.** Summer, part-time, or other professional-level employment in the field of planning, usually in an area of concentration; exposure to the social, political, and institutional setting in which planning operates; and full documentation of internship activities required. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units. Not more than 2 units of Urban Planning 440 and/or Urban Planning 340 may be applied toward the Master of Urban Planning degree, and these must be in addition to the other minima required by the Graduate College and the Department of Urban and Regional Planning.
463. **Housing and Urban Policy Planning.** The role of housing in social policy planning; methodologies for analyzing the housing market with regard to social planning issues; and demand and supply trends in American housing related to historic and projected social, economic, and physical changes. Prerequisite: Undergraduate course in micro-macro economics or consent of instructor. $\frac{3}{4}$ unit.
464. **Housing and Urban Planning Practice.** Housing location and developmental models; market analysis techniques; appraising and financing methodologies; and analysis of current housing programs and housing research. Prerequisite: Urban Planning 463; a course in statistics; consent of instructor. $\frac{3}{4}$ unit.
471. **Planning Strategies and Models.** Critical overview of current planning and decision-making models, with particular reference to their application to social problem solving in urban areas; interaction between the planning process and urban political systems. Prerequisite: Urban Planning 374 or consent of instructor. $\frac{3}{4}$ unit.
475. **Planning Methods.** Applied analytic methods in urban and regional planning, including survey research techniques, population analysis and projection, community economic and employment analysis, land-use and transportation studies, and evaluation techniques. Prerequisite: Urban Planning 376 or equivalent; consent of instructor. $\frac{3}{4}$ unit.
477. **Economics for Urban Planners.** Introduction to microeconomic and macroeconomic theory, in a context related to the needs of professional planners; special references to problems of land use, transportation, public facilities, and urban social problems; and techniques including theory of the firm, consumer theory, input-output analysis, and welfare economics. Prerequisite: Calculus. $\frac{3}{4}$ unit.
487. **Seminar.** Selected topics in urban and regional planning; several sections each semester. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
488. **Urban Planning Research.** Independent study in selected urban and regional planning topics. No more than 1 $\frac{1}{2}$ units may be applied toward the Master of Urban Planning degree. Prerequisite: Consent of instructor and head of the department. $\frac{1}{4}$ to $\frac{3}{4}$ unit.
492. **Seminar on Models for Directed Change.** Same as Sociology 492 and Social Work 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels; construction of models as interpretations of beha-

vioral science theory; extrapolation of hypotheses and of guides to intervention from the models; and readings from several disciplines as relevant. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.

499. **Thesis Research.** Prerequisite: Graduate standing in urban and regional planning; consent of the head of the department. 0 to 1 $\frac{1}{2}$ units.

VETERINARY BIOLOGICAL STRUCTURE

Head of Department: Professor J. E. Lovell

Department Office: 335 Veterinary Medicine Building, Urbana

300. **Gross Anatomy.** Same as Veterinary Medical Science 300. Systematic and topographic study and dissection of the dog; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 5 hours.
301. **Histology.** Same as Veterinary Medical Science 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, and skin; special reference to domestic animals. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 4 hours.
302. **Gross Anatomy.** Same as Veterinary Medical Science 302. Comparative study and dissection of the domestic animals with special reference to development and adaptation to function; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 4 hours.
303. **Microscopic Organology.** Same as Veterinary Medical Science 303. Microscopic study of the organs and systems of different domestic animals; lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
304. **Applied Anatomy, I.** Structural consideration of domestic and pet animals relative to diagnostic and surgical procedures; required in veterinary curriculum. Prerequisite: Registration in third year of veterinary curriculum or consent of instructor. 1 hour.
305. **Developmental Anatomy.** Same as Veterinary Medical Science 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals; lectures and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
306. **Applied Anatomy, II.** Continuation of Veterinary Biological Structure 304. Structural considerations of domestic and pet animals relative to diagnostic and surgical procedures; required in veterinary curriculum. Prerequisite: Veterinary Biological Structure 304 and registration in third year of veterinary curriculum, or consent of instructor. 1 hour.

VETERINARY CLINICAL MEDICINE

Head of Department: Professor A. J. Cawley

Department Office: 244 Small Animal Clinic, Urbana

360. **Medicine, I: General Medicine.** Diagnosis, treatment, and prophylaxis of infectious, noninfectious, and surgical diseases of the small domestic animals; lectures, quizzes, and demonstrations. Required in the veterinary curriculum. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.

361. **General Veterinary Surgery.** Surgical principles including hemostasis, shock, fluid, and electrolyte balance; discussion of the surgical procedures of the major systems of the body; the aftercare of the patients, both farm and domestic pet species; and laboratory covering practice and demonstrations of the principles of surgery involved in the major body systems. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
362. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases; lectures, quizzes, and demonstrations. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
363. **Reproduction, Obstetrics, and Genital Diseases.** Principles of animal reproduction, fertility, and obstetrics of all species of domestic animals, with emphasis on farm animals. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
364. **Medicine, II: General Medicine.** Diagnosis, treatment, and prevention of noninfectious, nutritional, metabolic, toxic, and parasitic diseases of large animals; lecture and discussion. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
365. **Special Veterinary Surgery.** Lectures and clinical demonstrations on surgical diseases and their diagnosis, operative treatment, and aftercare, together with appropriate laboratory practice. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 5 hours.
366. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
367. **Radiology and Radiobiology.** Same as Veterinary Physiology and Pharmacology 367. General principles of radiology and radiobiology techniques and application to the diagnosis and therapy of animal diseases; lectures and discussions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours.
368. **Infectious Diseases.** Diagnosis, treatment, and prophylaxis of infectious diseases of large animals; lectures, discussions, and quizzes. Prerequisite: Fourth-year standing in veterinary curriculum. 5 hours.
369. **Medicine, III: Preventive Medicine.** Diagnosis, treatment, and prophylaxis of contagious diseases of the dog and cat; diagnosis and treatment of diseases of the eye and ear; and lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 2 hours.
370. **Seminar.** Assigned reading and discussion of cases presented for diagnosis and treatment. Prerequisite: Fourth-year standing in veterinary curriculum. 0 credit.
371. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Fourth-year veterinary students enrolled in this course spend two days at the Dixon Springs Agricultural Center at Simpson, Illinois, where they participate in the fall roundup and gain valuable experience in the handling, examination, and treatment of diseases of range cattle; estimated cost, \$10.00. Transportation is furnished. Prerequisite: Fourth-year standing in veterinary medicine. 8 hours.
372. **Veterinary Jurisprudence.** Principles of law of importance to members of the veterinary profession; animal diseases and related regulatory laws and their administration; and federal procedure under animal disease and food and meat inspection laws. Prerequisite: Fourth-year standing in veterinary curriculum. 2 hours.
373. **Principles of Veterinary Medical Ethics.** Principles of veterinary medical ethics adopted by the American Veterinary Medical Association; these discussed together with the importance of professional ethics to members of the veterinary medical profession. Prerequisite: Fourth-year standing in veterinary curriculum. 0 credit.
374. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Fourth-year standing in veterinary curriculum. 10 hours.
375. **Reproduction, Obstetrics, and Genital Diseases.** Lectures, discussion, and laboratory practice in obstetrics, pregnancy diagnosis, and male and female infertility. Prerequisite:

site: Veterinary Clinical Medicine 363; third-year standing in veterinary curriculum. 2 hours.

376. **Economics and Business Management for the Veterinarian.** Summary of management in a practice of veterinary medicine; emphasis on the application of economic principles of record analysis, personnel management, business organization, and financial management. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
377. **Swine Practice Management.** Study of the interaction of diseases and modern swine production methods with emphasis on disease prevention and control; lectures, laboratories, and field trips for problem solving. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 3 hours.

VETERINARY MEDICAL SCIENCE

Head of Department: Professor L. M. Jones

Department Office: 141 Veterinary Medicine Building, Urbana

300. **Gross Anatomy.** Same as Veterinary Biological Structure 300. Systematic and topographic study and dissection of the dog; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Five hours of zoology; consent of instructor. 1 unit.
301. **Histology.** Same as Veterinary Biological Structure 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, and skin; special reference to domestic animals. Prerequisite: Consent of instructor. 1 unit.
302. **Gross Anatomy.** Same as Veterinary Biological Structure 302. Comparative study and dissection of the domestic animals; special reference to development and adaptation to function; and lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Medical Science 300 and 301; consent of instructor. 1 unit.
303. **Microscopic Organology.** Same as Veterinary Biological Structure 303. Microscopic study of the organs and systems of different domestic animals; lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. $\frac{3}{4}$ unit.
305. **Developmental Anatomy.** Same as Veterinary Biological Structure 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals; lectures and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. $\frac{3}{4}$ unit.
315. **Veterinary Physiology.** Same as Veterinary Physiology and Pharmacology 315. Nervous and muscular systems, respiration, acid-base balance, urine formation, and body fluids and their regulation; lectures, discussions, and laboratory. Prerequisite: Consent of instructor. 1 $\frac{1}{4}$ units.
316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Physiology and Pharmacology 316. Blood and lymph, circulation, digestion, metabolism, and endocrine systems; lectures, discussions, and laboratory. Prerequisite: Veterinary Medical Science 315 or consent of instructor. 1 unit.
318. **Pharmacology.** Same as Veterinary Physiology and Pharmacology 318. General principles of pharmacy and an analysis of the action of chemical agents on physiological processes; lectures, discussions, demonstrations, and laboratory. Prerequisite: Credit or concurrent registration in Veterinary Medical Science 315 and 316; consent of instructor. 1 unit.
320. **Pharmacology and Toxicology.** Same as Veterinary Physiology and Pharmacology 320. Principles of drug action and an analysis of action of chemical agents on living organisms; includes intoxications of domestic animals; lectures, discussions, and demonstrations. Prerequisite: Veterinary Medical Science 318 or consent of instructor. 1 unit.

332. **Veterinary Microbiology and Immunology.** Same as Veterinary Pathology and Hygiene 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance and the properties, pathogenesis, and control of viral and fungal infection of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or equivalent; consent of instructor. 1 unit.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Pathology and Hygiene 333. Protozoan and arthropod parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: A total of 20 hours in chemistry or animal biology, or both; consent of instructor. $\frac{3}{4}$ unit.
334. **General Pathology.** Same as Veterinary Pathology and Hygiene 334. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, and inflammation and neoplasia. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: A total of 25 hours in histology, parasitology, physiology, and microbiology; consent of instructor. 1 unit.
335. **Special Pathology.** Same as Veterinary Pathology and Hygiene 335. Disease processes affecting organs and anatomic systems, and those occurring in specific diseases; lectures, quizzes, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 334 or equivalent; consent of instructor. 1 unit.
336. **Helminth Parasites.** Same as Veterinary Pathology and Hygiene 336. Helminth parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: A total of 20 hours in chemistry or animal biology, or both; consent of instructor. $\frac{3}{4}$ unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. $\frac{3}{4}$ unit.
346. **Management and Diseases of Laboratory Animals.** Same as Veterinary Pathology and Hygiene 346. Principles of management of conventional and gnotobiotic laboratories; emphasis on proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. $\frac{1}{2}$ unit.
348. **Air Pollution Seminar.** Same as Civil Engineering, Agricultural Engineering, General Engineering, Geography, Mechanical Engineering, and Urban Planning 348. An interdisciplinary seminar on air pollution, including such topics as the health effects, and economic damage of air pollution, and its political, legal, urban planning, and engineering implications as related to control and enforcement. Prerequisite: Senior or graduate standing. $\frac{1}{2}$ unit.
369. **Introduction to Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology; emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. $\frac{1}{2}$ or 1 unit.
374. **Problems in Human Ecology.** Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; and multidisciplinary studies of selected current problems. Prerequisite: Veterinary Medical Science 369. 1 unit.
392. **Special Problems.** Individual research on a special problem chosen in consultation with the instructor and department head. Prerequisite: Registration in veterinary cur-

riculum with grade-point average of 4.0 or above, or consent of instructor. $\frac{1}{2}$ unit. May be repeated for a total of 1 unit.

408. **Principles of Hematology.** The cellular morphology of the blood and bone marrow of animals in health and disease; lectures, discussions, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 301 or equivalent, or consent of instructor. $\frac{1}{2}$ unit.
413. **Experimental Mammalian Physiology, I.** Same as Physiology 413. The physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
414. **Experimental Mammalian Physiology, II.** Same as Physiology 414. The physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
415. **Mechanisms of Microbial Infections.** Newer concepts of host-microorganism relations; emphasis on the dynamics and pathogenic mechanisms of microorganisms, immune responses and defense factors of the host, and pathogenesis of specific infections. Lectures, discussions, laboratory, and special problems. Prerequisite: Microbiology 326 or Veterinary Medical Science 332, or equivalent; consent of instructor. $\frac{3}{4}$ or 1 unit.
416. **Epizootiology.** Principles and problems of epizootiology; special consideration of the zoonoses; ecology of the host and parasite as related to resistance, adaptation, perpetuation, and distribution; the principles and factors in interference, carrier and latent states, and reservoirs and control. Prerequisite: Veterinary Pathology and Hygiene 331 or Veterinary Medical Science 332, or equivalent, or consent of instructor. 1 unit.
417. **Medical Mycology.** Study of the fungi that cause infections in man and animals; taxonomy, methodology, epidemiology, pathology, and diagnosis. Prerequisite: Microbiology 326 or Veterinary Medical Science 332, or equivalent. 1 unit.
418. **Concepts and Topics in Immunology.** Same as Biology 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunological tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor; Microbiology 327 and Biology 307 recommended. $\frac{1}{2}$ unit.
419. **Animal Virology.** Same as Microbiology 419. A discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology, supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327, or Veterinary Pathology and Hygiene 331 and Veterinary Medical Science 332; Biochemistry 350 or 354; consent of instructor. $\frac{3}{4}$ unit.
425. **Experimental Parasitology.** Same as Zoology 425. A broadly based consideration of the relation of parasites to their hosts and to their environments, and of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Biochemistry 350 and statistics recommended. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Veterinary Medical Science 340 or equivalent. $\frac{3}{4}$ unit.
445. **Advanced Macroscopic Pathology.** Concepts and interpretations of gross pathologic changes, and the integration of host-parasite reactions. Prerequisite: Veterinary Medical Science 334 and 335, or equivalent; consent of instructor. $\frac{1}{2}$ or 1 unit.
450. **Advanced Veterinary Pathology.** Advanced study of gross and microscopic pathology of diseases of domestic animals. Prerequisite: Veterinary Medical Science 335 or equivalent. 1 unit.
455. **Comparative Oncology.** A comparative study of the nature of mammalian and avian neoplasms based on general and special methods of tumor identification, classification,

and experimentation; lectures, demonstrations, and laboratory. Required course for students majoring in pathology in Department of Veterinary Medical Science. Prerequisite: Veterinary Medical Science 445 and 459, or equivalent. 1 unit.

457. **Ultrastructural Pathology.** Same as Biology 457. Ultrastructural basis of pathologic processes occurring in animal tissues and cells. Lectures, discussions, and reports. Prerequisite: Zoology 430; consent of instructor. $\frac{3}{4}$ or 1 unit.
459. **Advanced Correlative Pathology.** Discussion and interpretation of disease processes of domestic animals; emphasis on the correlation of gross, microscopic, and clinicopathologic findings with alterations of function. Prerequisite: Veterinary Medical Science 308, 335, 445 or 450, or equivalent; consent of instructor. 0 to 1 $\frac{1}{2}$ units.
460. **Advanced Veterinary Physiology.** Advanced study of physiology, nutrition, and biochemistry as related to problems in veterinary medical science; problems include white muscle disease, sweet clover disease, ketosis, hypoglycemia and digestive disturbances; and laboratory includes planning, executing, and reporting a specific course project. Prerequisite: Veterinary Medical Science 315 or 316, or equivalent; consent of instructor. 1 unit.
461. **Advanced Veterinary Pharmacology.** Evaluation of drugs, pharmacological aspects of biological antagonisms, chemotherapy, antibiotics, chelating agents and chemical biological correlation. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Animal Science 463 and Biophysics 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, and biology, and/or consent of instructor. 1 unit.
464. **Mineral Metabolism.** Physiology, nutrition, and biochemistry of minerals; mineral regulatory mechanisms; mineral membrane transport; and mineral abnormalities. Lectures, discussions, and reports. Prerequisite: Veterinary Medical Science 316, or Physiology 301 and 302, or equivalent; Biochemistry 350 or 354, or equivalent; consent of instructor. $\frac{3}{4}$ unit.
465. **Comparative Pharmacodynamics.** The comparative study of drug effects and the handling of drugs by various organisms; emphasis on mode of action of elements and chemical compounds; and factors influencing absorption, distribution, metabolism, and excretion of drugs. Prerequisite: Three courses in biology; four courses in chemistry including biochemistry; consent of instructor. $\frac{3}{4}$ unit.
466. **Comparative Environmental Toxicology and Drug Resistance.** The chemistry, mechanisms, actions, and disposition of substances toxic to man and other animals; nature of host-toxicant interactions; and the biological consequences of such interactions, including toxicological mechanisms and their public health significance. Prerequisite: Veterinary Medical Science 465 or consent of instructor. $\frac{3}{4}$ unit.
490. **Seminar.** Required of all graduate students whose major is veterinary medical science. $\frac{1}{4}$ unit.
491. **The Experimental Method in Veterinary Research.** Planning of experiments, use of controls, interpretation of results, sources of error, and writing the research report. $\frac{1}{2}$ unit.
492. **Special Problems.** Basic and applied study including orientation and research on pertinent initial and continuing problems in the student's area of interest. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit.
499. **Thesis Research.** 0 to 4 units.

VETERINARY MEDICINE

Program Administrator: Professor L. M. Jones

Program Office: 131 Veterinary Medicine Building, Urbana

392. **Special Problems.** Individual research on a special problem chosen after consultation with the instructor and department head. Prerequisite: Professional standing in veterinary curriculum; 3.5 grade-point average. 3 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 6 hours.

VETERINARY PATHOLOGY AND HYGIENE

Head of Department: Professor L. E. Hanson

Department Office: 57 Veterinary Medicine Building, Urbana

330. **Veterinary Medical History and Orientation.** Introduction to the history, recent developments, scope, and trends of veterinary medical education, practice, research, public health, and other areas; functions, obligations, and organization of the profession. Prerequisite: First-year standing in veterinary curriculum. 0 credit.
331. **Veterinary Bacteriology.** Study of the properties of bacteria responsible for diseases of domestic and wild animals; special emphasis on transmission, propagation, pathogenesis, and diagnosis. Prerequisite: First-year standing in veterinary curriculum or consent of instructor. 5 hours.
332. **Veterinary Microbiology and Immunology.** Same as Veterinary Medical Science 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance; the properties, pathogenesis, and control of viral infections of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or consent of instructor. 4 hours.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Medical Science 333. Protozoan and arthropod parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
334. **General Pathology.** Same as Veterinary Medical Science 334. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, and inflammation and neoplasms; lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
335. **Special Pathology.** Same as Veterinary Medical Science 335. Disease processes affecting organs and anatomic systems and those occurring in specific diseases; lectures, quizzes, demonstrations, and laboratory. Required in veterinary curriculum. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
336. **Helminth Parasites.** Same as Veterinary Medical Science 336. Helminth parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
337. **Clinical Pathology Conference.** Well-documented cases are presented to the student body with staff and student body participation in the discussion, the express purpose being more thorough integration of the basic sciences with clinical veterinary medicine. Prerequisite: Third-year standing in professional curriculum. 0 credit.
338. **Clinical Pathology.** Discussion of the function and interpretation of hematological, parasitological, chemical, and certain other procedures as aids in the diagnosis of animal diseases; emphasis on the correlation of laboratory findings with fundamental

changes and clinical manifestations of disease. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.

339. **Clinical Pathology Conference.** Well-documented cases are presented to the student with staff and student body participation in the discussion, the express purpose being more thorough integration of the basic sciences with clinical veterinary medicine. Prerequisite: Veterinary Pathology and Hygiene 337. 0 credit.
340. **Diseases of Poultry.** The causes, symptoms, lesions, prevention, and treatment of non-infectious and infectious diseases of domestic birds; lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 3 hours.
341. **Food Hygiene and Public Health.** General principles of public health; antemortem and postmortem inspection of food animals; the procedures and techniques used in the inspection of food of animal origin for type, class, and grade; and diseases of animals transmissible to man. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 5 hours.
346. **Management and Diseases of Laboratory Animals.** Same as Veterinary Medical Science 346. Principles of management of conventional and gnotobiotic laboratories; emphasis on proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 2 hours.

VETERINARY PHYSIOLOGY AND PHARMACOLOGY

Head of Department: Professor R. P. Link

Department Office: 263 Veterinary Medicine Building, Urbana

202. **Physiology of Domestic Animals.** Lectures, quizzes, and demonstrations. Prerequisite: Chemistry 101 or 102, or equivalent. 3 hours.
315. **Veterinary Physiology.** Same as Veterinary Medical Science 315. Nervous and muscular systems, respiration, acid-base balance, urine formation, and body fluids and their regulation; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Medical Science 316. Blood and lymph circulation, digestion, metabolism, and endocrine systems; lectures, discussions, and laboratory. Required in veterinary curriculum. Prerequisite: Veterinary Physiology and Pharmacology 315 or consent of instructor. 4 hours.
318. **Pharmacology.** Same as Veterinary Medical Science 318. General principles of pharmacy and an analysis of the action of chemical agents on physiological processes; lectures, discussions, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 4 hours.
320. **Pharmacology and Toxicology.** Same as Veterinary Medical Science 320. Principles of drug action and an analysis of the action of chemical agents on living organisms, including intoxications of domestic animals. Lectures and laboratory. Prerequisite: Veterinary Physiology and Pharmacology 318 or consent of instructor. 4 hours.
324. **Nutritional Aspects of Large Animal Medicine.** Clinical aspects of nutritional deficiencies, imbalances, and toxicities in cattle, horses, and swine; presentation of therapeutic principles; and nutritional aspects of the etiology, prevention, and treatment of specific disease conditions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours.

326. **Nutritional Aspects of Small Animal Medicine.** Clinical aspects of nutritional deficiencies, imbalances, and toxicities in small animals; presentation of therapeutic principles; and nutritional aspects of the etiology, prevention, and treatment of specific disease conditions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 1 hour.
367. **Radiology and Radiobiology.** Same as Veterinary Clinical Medicine 367. General principles of radiology and radiobiology including techniques and application to the diagnosis and therapy of animal diseases; lectures, discussions and laboratories. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 3 hours.

VOCATIONAL AND TECHNICAL EDUCATION

Chairman of Department: Professor L. J. Phipps

Department Office: 345 Education Building, Urbana

101. **Nature of the Teaching Profession.** Introduction to educational problems; a general study of the nature of teaching; its opportunities and responsibilities. Through individual work, the student is helped to evaluate his potentialities for teaching. 2 hours.
181. **Introductory Woodwork.** Beginning course in hand woodwork, with emphasis on both manipulative skills and related technical material. One section of this course is offered for majors in industrial education and another for students in the occupational therapy curriculum. 4 hours.
182. **Advanced Course in Woodwork.** Advanced course in design and construction of woodwork projects with related technical information. Prerequisite: Vocational and Technical Education 181. 4 hours.
183. **General Metalwork.** A basic course in general metalwork; materials, tools, problems, and processes in bench metalwork, foundry, and introductory gas and arc welding. 4 hours.
188. **General Shop for Elementary and Special Education Teachers.** Includes manipulative processes and the study of tools and materials appropriate for craft and shop activities in the elementary school and in special education classes. 3 hours.
189. **Supervised Occupational Experience.** Provides students preparing to teach in the vocational and technical fields the occupational experience necessary or appropriate to complete the requirements in these curricula. Students who are employed and concurrently enrolled in this course complete assignments covering the related technical information of their chosen fields and undergo regularly scheduled written, oral, and performance examinations. Application for a job assignment must be made three months prior to the semester in which placement is desired. Prerequisite: Sophomore standing. 2 or 3 hours. May be repeated to a maximum of 17 hours.
199. **Undergraduate Open Seminar.** 0 to 9 hours.
240. **Principles of Vocational and Technical Education.** Provides each specialized educational worker with a common orientation as to the major responsibilities of the public school as a unit and to his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Vocational and Technical Education 101; Psychology 100. 2 to 4 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper five percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
270. **Technic and Curriculum Development for Teaching Secretarial and Office Practice Subjects.** Review of results of current research and experimentation in the teaching of

typewriting, shorthand, and other office practice subjects; review of basic education principles relative to skill development; and introduction to the use of new innovations and technology, and their implications for office education. Proficiency level in typewriting and shorthand must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.

271. **Technic and Curriculum Development for Teaching Data Processing and Office Machines.** Introduction of techniques for teaching the operation of a variety of office machines used for processing data; introduction of current methods of teaching the use of automated data-processing equipment and requirements for employment. Proficiency level in the operation and theory of operation of office machines used for processing data must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.
275. **Summer Experience in Agricultural Education.** Supervised experience in the work of a teacher of vocational agriculture during a two- or three-week period in the summer; planning summer work; teaching adult classes; supervising the farm practice of high school and adult students; advising school-sponsored organizations; counseling students; studying a community; becoming acquainted with facilities for agricultural education; and becoming familiar with situations in which the student will later do six weeks of student teaching during a school year. Course work is completed during the summer with official registration in the fall semester. Prerequisite: History and Philosophy of Education 201. 2 or 3 hours.
276. **Student Teaching in Vocational Agriculture.** Supervised experience in the work of a teacher of vocational agriculture during a six-week period; planning programs of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; and keeping records and making reports. Prerequisite: History and Philosophy of Education 201 and Vocational and Technical Education 240, or consent of instructor; concurrent registration in Vocational and Technical Education 277. 5 hours.
277. **Programs and Procedures in Agricultural Education.** Preparation for a successful experience in practice teaching and for beginning work as a teacher of vocational agriculture; procedures in planning a community program of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; and keeping records and making reports. Prerequisite: History and Philosophy of Education 201 and Vocational and Technical Education 240, or consent of instructor; concurrent registration in Vocational and Technical Education 276. 5 hours.
278. **Vocational Home Economics Education for Youth and Adults.** Preparation for work as a teacher in vocational home economics programs for youth and adults; study of procedures for planning, organizing, executing, and evaluating home economics occupational programs. Prerequisite: Senior standing and permission of instructor. 3 hours.
280. **General Drafting for Teachers.** An integrating course to prepare industrial education students to teach drafting; deals primarily with the problems of organizing and teaching drafting courses. Prerequisite: General Engineering 101; Architecture 141. 3 hours.
284. **Advanced Metalwork.** Intermediate and advanced operations with hand and machine tools; the designing, planning, and constructing of machine shop projects; and a study of ferrous and nonferrous materials appropriate for machine shop work. Prerequisite: Vocational and Technical Education 183. 4 hours.
285. **General Electricity.** A basic course in introductory general electricity, theory, and shop practice; principles of electricity applied to elementary shop problems in areas of house wiring, communications, construction and repair of household appliances, and fractional horsepower motors and generators. Prerequisite: Vocational and Technical Education 183. 3 hours.
287. **General Electronics.** A basic course in introductory general electronics, theory, and shop practice; vacuum tube circuit principles applied to shop problems in the areas of

radio and television communications, audio reproduction and transmission systems, and industrial control systems for industrial arts teachers. Prerequisite: Vocational and Technical Education 285. 3 hours.

291. **Thesis.** Prerequisite: Senior standing. 2 hours.

292. **Thesis.** Prerequisite: Senior standing. 2 hours.

349. **Special Study and Investigation in Vocational and Technical Education.** Offers opportunity for an individual to study, on or off campus, selected problems, trends, and new developments or to conduct specialized technological investigations for the improvement of instructional programs in areas related to vocational and technical education. Prerequisite: Consent of instructor; demonstrated ability to pursue special study or investigation proposed. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

370. **Agricultural Education for First-Year Teachers.** Specific help with the problems of beginning teachers; campus meeting in August; other meetings in centers in the state convenient to first-year teachers; and visits by instructors to schools in which first-year teachers are employed. Prerequisite: Vocational and Technical Education 276 and 277. 3 hours or $\frac{1}{2}$ unit.

381. **Principles of Vocational Education.** Study of basic concepts and practices of modern vocational education. 3 hours, or $\frac{1}{2}$ or 1 unit.

382. **Cooperative Vocational and Technical Education Programs.** Provides the specific professional background required of teachers, coordinators, and administrators who organize and conduct public school programs utilizing community resources and experiences; includes the background, philosophy, organization, and administration of cooperative education. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.

383. **Development, Organization, and Principles of Industrial Education.** A survey of the problems and practices of the several phases of industrial education. 3 hours, or $\frac{1}{2}$ or 1 unit.

384. **The General Shop Program.** A laboratory and theory course in the organization and administration of the industrial arts general shop program. Prerequisite: Sixteen hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.

385. **Problems in Concurrent Work-Education.** While employed in approved cooperating business firms, students observe the relationships between their activities and the specialized educational programs in the high school and community college; in class sessions, emphasis on job analysis, current trends, wage and benefit structure, personnel practices, labor relations, and their implications for teaching. Prerequisite: Completion of prescribed courses in vocational and technical education for teaching in their area of specialization; consent of instructor. 4 hours or 1 unit.

387. **Training Programs in Industry.** Study of the organization, instruction, supervision, and evaluation of training programs conducted within industry and their relationships to other educational agencies. 4 hours or 1 unit.

388. **Special Techniques of Teaching Vocational-Industrial Subjects.** Study of the application of principles of industrial education in vocational-industrial education; stress on methods of developing industrial skills, appropriate vocational attitudes, and related technical knowledge; and lectures, discussions, and demonstrations. Prerequisite: Junior standing; 10 hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.

399. **Issues and Developments in Vocational and Technical Education.** A special course for experimentation or for seminar on topics not treated by regularly scheduled courses; requests for initiation of this course may be made by students or faculty members. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated for a maximum of 8 hours or 2 units.

442. **Junior College.** Same as Higher Education 442. The place of the junior college in the modern program of public education; social, economic, and other changes responsible for development of postsecondary education as found in junior colleges, area vocational schools, and technical institutes. 1 unit.

445. **Investment in Human Resources.** Same as Labor and Industrial Relations 445. Activities which influence future monetary and psychic income by improving the resources in people; investments include schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes, with main emphasis on education. A last section covers educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.
448. **Continuing Education.** Same as Secondary Education 448. Development, status, and prospects of continuing education for adults; institutions, agencies, and programs; public policy and policy making for continuing education; organization, administration, finance, and promotion; recruiting, training, and supervising staff; planning programs and courses; and the literature of continuing education. Systematic study of individual problems supplements class work. $\frac{1}{2}$ or 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the dean of the College of Education.
450. **Evaluation in Home Economics Education.** Theory and techniques of evaluation in home economics at different educational levels; analysis and refinement of instruments, interpretation of results for self-evaluation and guidance, and effective administration of programs. 1 unit.
451. **Directing Personnel Development in Vocational, Technical, and Practical Arts Education.** Principles and techniques for development of personnel in programs of vocational, technical, and practical arts education; emphasis on personnel development and instructional supervision of paraprofessionals, employers, and foremen of vocational and technical education students. Prerequisite: One unit in vocational and technical education or consent of instructor. 1 unit.
453. **Problems in Home Economics Education.** Prepares consumers of research through a comprehensive study and evaluation of home economics investigations now available and through the experience of carrying out an individual investigation of limited scope. 1 unit.
456. **Problems and Trends in Specialized Fields of Vocational and Technical Education.** Introduction to significant problems, points of view, and trends in the field concerned; explores significant research relating to organization, content, and techniques in the field in question. Students are encouraged to make special studies in approved areas. 1 unit.
459. **Workshop in Curriculum Development.** Curriculum development projects in the specialized fields of agriculture, business, home economics, health, and industry. $\frac{1}{2}$ to 2 units.
471. **Policy and Program Development in Vocational, Technical, and Practical Arts Education.** Local, state, and national policies for vocational and technical education; organizing for policy making and program development; and developing desirable policies and programs. 1 unit.
472. **Course Planning and Teaching Procedures in Agricultural Occupations Programs.** Gathering data essential in course planning, constructing course plans, and developing resource units, teaching procedures, and instructional aids. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{1}{2}$ unit.
473. **Vocational Education in Agriculture for Adults.** The case for adult education, needs of young and adult farmers for education, development and present status of adult education in agriculture, objectives, evaluation, using advisory committees, organizing adult classes, enrolling students, course planning, teaching procedures and aids, supervised practice, group activities, and facilities. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{1}{2}$ unit.

474. **Supervised Agriculture Experience in Agricultural Occupations Programs.** Supervised agricultural experience programs as an educational strategy; importance and meaning of supervised agriculture experiences; planning, conducting, supervising, and evaluating agriculture experience programs; relation of supervised agriculture experience programs to establishment and advancement in an occupation; keeping and using records; and relating class instruction to supervised agriculture experience programs. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. ½ unit.
475. **Organizing and Teaching Agriculture Mechanics.** Agriculture mechanics as a phase of vocational education in agriculture: purposes, course planning for high school students, young farmers, and adults; methods of teaching and evaluating on-farm or on-job instruction; planning agriculture-mechanics shops and facilities; and providing and teaching safety in agriculture mechanics. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. ½ unit.
476. **Guidance in Vocational, Technical, and Practical Arts Education.** The guidance function of a vocational or technical teacher; identifying and selecting students for vocational and technical programs; determining manpower and job requirements; providing occupational information; placing graduates; counseling parents, students, foremen, advisory committee members, union members, and employers; and conducting follow-up studies. 1 unit.
481. **History and Basic Concepts of Vocational and Technical Education.** The historical development of modern vocational education; the educational theories underlying its development; and the educational concepts upon which present programs and procedures are based. 1 unit.
482. **Research Studies in Vocational and Technical Education.** Study and evaluation of examples of research in this field; consideration of the research needed to solve present problems. Each student proposes and completes a brief research project, or plans in detail a major research project to be completed later. 1 unit.
487. **Seminar in Vocational, Technical, and Practical Arts Education.** Overview and interpretation of social, economic, and technological trends which have relevance to the problem of developing new programs in the vocational, technical, and practical arts areas; analysis and evaluation of innovations in the field; and current issues and problems. Prerequisite: Graduate standing in vocational and technical education. 1 unit.
488. **Curriculum Problems and Trends in Industrial Education.** Selection and organization of instructional materials for industrial courses; study of basic concepts underlying course construction in industrial education. Prerequisite: Undergraduate work in appropriate vocational and technical education courses. 1 unit.
489. **Administration of Vocational and Technical Education.** Problems and approved practices in the administration and supervision of programs of vocational, technical, and practical arts education in secondary schools, junior colleges, and technical institutes. Prerequisite: Consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in vocational and technical education open only to persons who have been admitted for doctoral study in vocational and technical education; sections are usually offered in the following areas: (a) industrial education, (b) agricultural education, (c) home economics education, (d) business education, and (e) general vocational and technical education. 1 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; each student presents his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

YORUBA

(See Linguistics)

ZOOLOGY

(See Life Sciences)

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Additional Information

For information about admission requirements of a particular curriculum, school, or college, or general questions about the University and its offerings and requirements, write or talk to the

**DIRECTOR OF ADMISSIONS AND RECORDS, 100A Administration Building,
University of Illinois at Urbana-Champaign, Urbana 61801**

The director of admissions and records will also send you on request a copy of the *Graduate Programs* catalog and the semester *Timetables*. The *Undergraduate Programs* catalog is available at high schools, junior colleges, and public libraries in the state of Illinois.

Publications of the following colleges and departments of the University may be obtained by writing directly to the unit concerned:

College of Agriculture	Graduate College
Institute of Aviation	Institute of Labor and Industrial Relations
College of Commerce and Business Administration	College of Law
College of Communications	Graduate School of Library Science
College of Engineering	College of Physical Education
College of Fine and Applied Arts	Jane Addams School of Social Work
	College of Veterinary Medicine

About matters of finance, loan funds, part-time employment, student use of motor vehicles, or other questions involving student welfare and campus life, write or talk to the

**DEAN OF STUDENTS
University of Illinois at Urbana-Champaign
310 Student Services Building, Champaign 61820**

About matters of housing, write or call at the office of the

**HOUSING DIVISION
University of Illinois at Urbana-Champaign
420 Student Services Building, Champaign 61820**

About matters concerning services and facilities for permanently physically handicapped students, write to

**DIVISION OF REHABILITATION-EDUCATION SERVICES
University of Illinois at Urbana-Champaign
Oak Street and Stadium Drive, Champaign 61820**

About matters concerning a veteran's educational status and plans, write to

**VETERANS EDUCATIONAL BENEFITS
University of Illinois at Urbana-Champaign
420 Student Services Building, Champaign 61820**

About matters especially referring to the Chicago Circle campus, including a catalog, write or talk to the

**DIRECTOR OF ADMISSIONS AND RECORDS
University of Illinois at Chicago Circle, Chicago
Mailing Address: P.O. BOX 4348, Chicago, Illinois 60680**

About matters especially referring to the University of Illinois at the Medical Center, including the publications of the Colleges of Dentistry, Medicine, Nursing, and Pharmacy, write or talk to the

**DIRECTOR OF ADMISSIONS AND RECORDS
University of Illinois at the Medical Center, 1853 West Polk Street, Chicago
Mailing Address: P.O. Box 6998, Chicago, Illinois 60680**

For matters concerning a particular college, school, institute, or bureau which cannot be answered by one of the publications or sources listed above, write or talk to the dean or director of the unit in question.

Courses Catalog

**University
of Illinois
at Urbana-
Champaign**

The University of Illinois is in full compliance with all federal and state nondiscrimination and equal opportunity laws, orders, and regulations, and will not discriminate against any person because of race, color, sex, religion, or national origin in any of its educational programs and activities.

For additional information on the equal opportunity and affirmative action policies of the Urbana-Champaign campus, please contact the office of Walter Strong, Assistant Vice-Chancellor for Academic Affairs and Affirmative Action.

1976-78

Courses Catalog

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

(217) 333-1000

independent study. In description of courses, "3 hours" means 3 hours of credit each semester or summer session.

Credit for graduate students taking courses numbered 300 and above usually is counted in units. One unit is considered the equivalent of 4 semester hours of credit.

Undergraduate students wishing to enroll in courses numbered 300 and above for graduate credit or in 400-level courses for undergraduate credit must obtain the advance approval of the Graduate College.

Each undergraduate student is expected to pursue a normal program of studies; the number of hours required varies with the college and the curriculum. More or less than a normal program may be permitted only by the dean of the student's college or the dean's representative. To be eligible for participation in specified undergraduate student activities, the student must carry 12 hours in a semester. Twelve credit hours and above (3 units and above) in a semester comprise a full program of study for tuition and fees assessment; in an eight-week summer session the number of hours is 6 semester hours and above (1½ units and above). For information about criteria determining eligibility for Dean's List recognition, interested students should contact their college offices.

The minimum program required for receipt of maximum educational benefit payments under the Veterans Readjustment Benefits Act of 1966 and for receipt of social security benefits as a dependent is 12 hours (or 3 units) in a semester and 6 hours (or 1½ units) in an eight-week summer session.

Detailed information relating to admission, costs, and graduation requirements is given in the *Undergraduate Programs* and *Graduate Programs* catalogs. (See back inside cover for additional sources of information.)

ACCOUNTANCY

Head of Department: Professor N. M. Bedford

Department Office: 360 Commerce Building (West), Urbana

101. **Principles of Accounting, I.** Basic accounting and business concepts; principles of recording business transactions; cash records and control; periodic adjustment of transaction data; financial statement presentations; and relationship of accounting to business. Prerequisite: Sophomore standing. 3 hours. Credit is not given for both Accountancy 101 and 201.
105. **Principles of Accounting, II.** Accounting and reporting principles of partnerships, corporations, branches, departments, and enterprises with incomplete records; interpretation of financial statements; basic valuation and cost concepts; and control of manufacturing costs through product costing, process costing, standard costs, and budgeting. Prerequisite: Accountancy 101; sophomore standing. 3 hours. Credit is not given for both Accountancy 105 and 201.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Fundamentals of Accounting.** A survey course in the principles of accounting for non-commerce students only. 3 hours. Credit is not given for Accountancy 201 and Accountancy 101 or 105.
203. **Business and Accounting Methods.** For students in professional curricula who will be confronted with accounting, tax, and business problems in connection with an independent practice. Not open to commerce students. Prerequisite: Junior standing. 2 hours.
206. **Cost Accounting for Engineers.** The elements of manufacturing costs and the influence of such costs and other accounting factors upon engineering design and production processes; correlation of engineering and accounting concepts and procedures. Not open to students who have credit in Accountancy 101 or 201. Prerequisite: Junior standing in engineering. 3 hours.
208. **Intermediate Accounting.** Accounting theory and concepts with an analysis of the special problems that arise in applying these underlying concepts to financial accounting; emphasis given to the use of accounting information as a basis for decisions by management, stockholders, creditors, and other users of financial statements and accounting reports. Prerequisite: Accountancy 105. 4 hours.
218. **Elementary and Intermediate Accounting.** An accelerated course designed for students with advanced standing and no prior preparation in accounting who desire to major in accountancy; fundamentals of proprietorship, partnership, and corporation accounting; consideration at the intermediate level of modern basic concepts of accounting theory; and interpretation of financial statements and analysis of the principal accounts represented therein. Prerequisite: Junior standing; general University grade-point average of 3.5 or consent of head of department. 5 hours.
266. **Cost Accounting.** Use of costs for control and decision making, with emphasis on standard costs, relevant costs, direct costing, nonmanufacturing costs, and responsibility accounting; for students who have already studied the basic elements of job order, process costs, and budgeting. Prerequisite: Accountancy 105. 3 hours.
274. **Basic Federal Income Tax Accounting.** Basic discussion of history, theory, and broad outlines of federal income taxation for individuals, partnerships, and corporations, including the more important basic concepts involved in federal income taxation. Prerequisite: Accountancy 105 or 201. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the

honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.

325. **Accounting System Design.** Introduction to the fundamentals of accounting system design including the design and use of business papers, records, and reports; the functions of business machines in accounting systems; and personnel problems in accounting system design. Prerequisite: Accountancy 266; Computer Science 105 or equivalent. 3 hours or $\frac{3}{4}$ unit.
341. **Governmental Accounting.** Accounts of institutions, of municipalities, and of state and federal governments; organization, procedure, budget, accounts and records, reports, and audits. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
362. **Business Budgets and Accounting Control.** Procedures used in the preparation of business budgets and the principles underlying these procedures; a complete budget is prepared by the student for a typical manufacturing company. Prerequisite: Nine hours of accountancy, including Accountancy 266. 3 hours or $\frac{3}{4}$ unit.
366. **Managerial Accounting and Quantitative Techniques.** Application of quantitative and mathematical techniques to managerial accounting problems including empirical methods, network techniques, probabilistic methods, linear algebra, sensitivity analysis, and other methods. Prerequisite: Accountancy 266; Economics 172; Mathematics 124. 3 hours or $\frac{3}{4}$ unit.
367. **Managerial Accounting and Organizational Controls.** A study of managerial accounting and its functioning as an information subsystem, in relationship to the system of organization and the attainment of the goals of the enterprise; stresses the interactions of the components of the enterprise in response to information generated by the managerial accountant. Prerequisite: Accountancy 266; senior standing. 3 hours or $\frac{3}{4}$ unit.
371. **Auditing.** Nature of audit evidence; basic audit techniques; audit practices and procedures; professional ethics; and audit reports. Prerequisite: Accountancy 208, Economics 172, and Computer Science 105. 3 hours or $\frac{3}{4}$ unit.
372. **Auditing Problems and Cases.** Application of auditing principles in verification of financial statements; preparation of reports; case studies applicable to specific industries; and current trends. Prerequisite: Accountancy 371. 3 hours or $\frac{3}{4}$ unit.
374. **Advanced Income Tax Problems.** Practical and theoretical training in the more common and important provisions of the federal income tax, advanced problems, and tax case research and preparation. Prerequisite: Senior standing; Accountancy 274. 3 hours or $\frac{3}{4}$ unit.
376. **Advanced Accounting.** General theory; accounting applications of compound interest; accounting for price level changes; partnerships; fiduciaries; and recent developments in accounting theory and practice. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
377. **Advanced Problems.** Consolidated statements; branch accounting; business combinations; foreign exchange; business reorganizations; and recent developments in theory and practice. Prerequisite: Accountancy 208. 2 hours or $\frac{1}{2}$ unit.
378. **Advanced Theory and Practice.** Selected problems from CPA examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; and theory, auditing, and ethics. Prerequisite: Accountancy 274, 371, 376, and 377. 3 hours or 1 unit.
391. **Introduction to Management Information Systems.** Same as Business Administration 391. Introduction to the fundamentals of information systems technology, techniques, and capabilities, particularly with respect to the use of information systems in an administrative setting. Prerequisite: Computer Science 105 or equivalent, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
392. **Information Organization for Management Information Systems.** Same as Business Administration 392. Data collection, classification, verification, and transmission; file organization, including sequential and random processing techniques, record locating, overflow procedures, and file security; analysis of alternative methods of data organization; commercial file management systems; design of data processing systems; and in-

struction in COBOL and use of case studies. Prerequisite: Accountancy/Business Administration 391 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

- 393. Management Information System Development.** Same as Business Administration 393. Essential steps in developing a management information system, including preliminary planning, design, feasibility analysis, implementation schedule, and postimplementation review of the system; includes a semester-long project which familiarizes students with methodology and techniques. Prerequisite: Accountancy/Business Administration 391 or 392, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
- 394. Management Information and Control Systems.** Same as Business Administration 394. Integration of behavioral, quantitative, and system design concepts in relation to professional work in the management information systems area. Prerequisite: Accountancy/Business Administration 393 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
- 432. Accounting Under Different Social Systems.** An inquiry into the ways accounting has been adapted to the needs of different social systems; the extent of its contribution; and its apparent limitations. Consideration is also given to the relationship between accounting and the growth and development of social systems. 1 unit.
- 441. State and Federal Accounting Theory.** Advanced study in accounting and other fiscal procedures of the federal government; state, county, and municipal governments; and institutions. 1 unit.
- 450. International Accounting Theory and Practice.** Accounting methods and procedures, theories and thoughts of several countries analyzed and evaluated on a comparative basis; different approaches and solutions to similar accounting problems related to influences of tradition, environment, political ideas, etc.; special attention given to financial and managerial accounting problems of multinational corporations. Prerequisite: Undergraduate major in accounting or consent of instructor. 1 unit.
- 455. Macroaccounting.** Same as Economics 425. An examination of the fundamental concepts underlying the attempts to measure the economic activities of macro units; similarities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macroaccounting statements and analyses; and usefulness of macroaccounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macroeconomic theory or consent of instructor. 1 unit.
- 461. Administrative Accounting.** Accounting as a tool for management: organization of accounting department, coordination of departmental operations, control of assets, control of operations, management audits, accounting aspects of coordinating the business with market conditions, cooperation with public accountants and government agencies, and social responsibilities. 1 unit.
- 462. Management Accounting, I.** An examination of recent conceptual and analytical developments in the area of management accounting; includes a study of modern and relevant planning and control techniques and their underlying concepts as applied to the various functional areas within the firm. Prerequisite: An undergraduate course in management accounting. The student's background in statistics and mathematics should be equivalent to the undergraduate requirements of the University of Illinois College of Commerce and Business Administration in these areas. 1 unit.
- 466. Cost Accounting Theory and Analysis.** A critical examination of cost-accounting methods as to truth and expediency. 1 unit.
- 472. Auditing Standards and Techniques.** A critical analysis of the techniques used in auditing; interrelation of audit standards, procedures, principles, and techniques; internal control as related to audit techniques; and trends and developments in the accounting profession. 1 unit.
- 473. The Theory of Accounting System Design.** Problems and procedures in connection with designing and installing accounting systems. 1 unit.
- 474. Income Tax Development.** A theoretical and historical approach to the study of the development of federal income taxation, together with some research on tax cases and critical appraisal of the current law and proposals for its revision. 1 unit.

481. **Concepts and Principles.** The fundamental structure of accounting theory developed through the study of concepts characteristic of accounting and an examination of the literature dealing with the concise formulation of accounting principles. 1 unit.
483. **Income Measurements.** A study of the pros and cons of various unsettled issues involved in the calculation and disclosure of enterprise periodic income. 1 unit.
485. **Relationship of Accounting Theory to Philosophy, Science, and Other Disciplines.** An examination of the relationship of accounting theory to the developments, thoughts, and methods in the fundamental intellectual disciplines. 1 unit.
489. **History of Accounting Theory.** An examination of the more important aspects of accounting theory under the impact of changing conditions over four centuries, with major emphasis on the later developments. 1 unit.
493. **Special Research Problems.** Individual investigations or research projects selected by the students, subject to approval by the graduate adviser and the executive officer of the department. $\frac{1}{4}$ to 2 units.
499. **Thesis Research.** Individual direction and guidance in writing theses; seminar discussion of progress made. 0 to 4 units.
501. **Accounting Analysis, I.** Uses of accounting information; collection, processing, and communication of accounting information; measurement of assets, liabilities, equities, and income; and accounting system design. 1 unit.
502. **Accounting Analysis, II.** An in-depth study of accounting valuation processes and accounting income measurement; special reporting problems of multiple-entity organizations; and accounting for nonprofit organizations. Prerequisite: Accountancy 501 or equivalent. 1 unit.
503. **Managerial Accounting.** Introduction to management accounting as part of the firm's information system, in terms of modern cost accounting and budgetary systems for planning and controlling business operations. Prerequisite: Credit or registration in Accountancy 501 or equivalent. 1 unit.
504. **Taxation and Auditing.** Introduction to historical and conceptual material in specialized accounting areas of taxation and auditing; emphasis centered on provisions of the tax law relevant to accounting measurement methods and on nature of evidence in auditing, auditing standards and techniques, and ethical constraints imposed on the auditor. Prerequisite: Accountancy 501 or 503, or equivalent. 1 unit.
562. **Industrial Cost Control.** Study of cost accounting with emphasis on the use of operating data by management for control purposes; methods of material pricing and labor costs including fringe benefits; indirect manufacturing costs, direct costing, and standard costs; estimated and statistical costs; distribution costs; contribution to overhead theory; depreciation and replacement of equipment; selection of plant; decision to make or buy; and relation between costs and pricing policy. Prerequisite: Business Administration 460 or equivalent. 1 unit.
563. **Controllership.** The controller in the business organization: property control responsibilities; internal check; internal audits; insurance; assistance to operating management through budgeting, break-even analysis, and profitability studies; relationship with groups outside of management such as investors and government agencies; and emphasis on the manner in which the figure function of controller is used to integrate the operations of the business enterprise. Prerequisite: Accountancy 562 or equivalent, or Business Administration 460 and consent of instructor. 1 unit.
566. **Management Accounting, II.** Development of the role and importance of accounting data in conjunction with modern quantitative methods in the process of industrial enterprise administration; attention focused on the use of existing accounting data in models and the demands on data accuracy and reliability as well as the necessity to develop additional data for the purpose of facilitating integrated planning, budgeting, and control processes. 1 unit.
577. **Professional Problems.** Instruction as to types and methods of solution of professional problems in public accounting, including practice in analyzing and solving a wide variety of such problems. 1 unit.

594. **Methods and Practices in Professional Research.** Instruction in research methods, materials, and techniques together with individual practice in conducting and reporting specific professional research projects. 1 unit.

ADMINISTRATION, HIGHER, AND CONTINUING EDUCATION

Chairperson of Department: Professor M. Burlingame

Department Office: 333 Education Building, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
267. **The American College.** A survey of the American college and university; its history, structures, problems, trends, and governance. Provides an opportunity to explore the nature and scope of higher education in the United States. 3 hours.
362. **Adult Learning and Development.** Same as Educational Psychology 362. Theory of and research on adult learning and development; includes societal context, performance, physiology and health, personality, and learning; and considers stability and change during young adulthood, middle age, and old age. Prerequisite: Educational Psychology 311 or 312, or equivalent. 4 hours or 1 unit.
380. **Continuing Education General Seminar.** Introductory analysis of literature and professional practice in continuing education of adults; for beginning graduate students majoring in continuing education and for non-majors. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
430. **Elementary School Organization and Administration.** Principal focus given to conceptual analyses of administrative and supervisory functions of the elementary school; examination of administrative roles in the design, implementation, and improvement of the total educational program; and intensive use of research skills and strategies in the investigation of problems of instruction. In summer sessions this course is restricted to those without experience in administration and must be taken with Administration, Higher, and Continuing Education 464. Intended primarily for candidates for the master's degree. Prerequisite: Consent of instructor. 1 unit.
438. **Instructional Supervision.** Methods, theories, and research applying to supervision at all levels of public education; analyses made concerning the work of curriculum directors, general supervisors, special supervisors, supervising principals, and department heads; study of supervisory methods, current plans for staff utilization, and use of instructional materials; and stress on evaluation of educational programs and of the effects of supervision. Prerequisite: Elementary and Early Childhood Education 439 or Secondary Education 439; Administration, Higher, and Continuing Education 450. 1 unit.
440. **Administration and Supervision of Junior and Senior High Schools.** Principal focus given to conceptual analyses of administrative and supervisory functions of the secondary schools; problems then projected through case studies and situational descriptions as a means of examining tasks and processes in such areas as curriculum and instruction, pupil and staff personnel, student activities, school organization, and management and school-community relationships. In summer sessions this course is usually taken with Administration, Higher, and Continuing Education 464. Intended primarily for candidates for the master's degree. Prerequisite: Administration, Higher, and Continuing Education 450 or consent of instructor. 1 unit.
442. **The Community College.** Same as Vocational and Technical Education 442. Community colleges and vocational-technical institutes: their purposes, function, and objectives; social forces related to their development and evaluation; characteristics and

needs of students; educational programs and teaching strategies; and organization, control, and financing. 1 unit.

443. **The College Student.** Study of the characteristics and development of college students, the institutional contexts in which they operate, and the interaction of students with the college environment. 1 unit.
448. **Continuing Education Program Development.** Same as Secondary Education 448 and Vocational and Technical Education 448. Analysis of the process of planning and conducting continuing education programs for adults; includes theory, research, and practice regarding sponsors, need appraisal, objectives, selection and organization of learning activities, and evaluation. Recommended for majors in continuing education. Prerequisite: Consent of instructor. Administration, Higher, and Continuing Education 362 is recommended, especially for majors in continuing education. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student, and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ to 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
450. **Public Control and Administration of Education.** Basic understanding of theory and practice in operation and control of schools useful to teachers and other citizens; introductory course for prospective administrative officers and supervisors. Not open to experienced administrators nor to students who have taken any of the following (or equivalents): Administration, Higher, and Continuing Education 430, 440, 461, 462, 463, 465, or 466. 1 unit.
451. **Administration of Educational Program.** Overview of the theory underlying the development and administration of educational programs; study of various program models and the relationships among elements of curriculum; and primary emphasis to the diverse considerations which influence program administration in schools serving today's complex society. Prerequisite: Administration, Higher, and Continuing Education 450 or consent of instructor. 1 unit.
452. **Current Issues in Higher Education.** Seminar on current issues, problems, and trends in higher education. Prerequisite: Two units in higher education or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
453. **Conceptual Approaches to Educational Administration.** Focus on the human and organizational dimensions of administration internal to the school system; foundation of selected social science concepts and theories for analyzing and understanding educational administration. Prerequisite: Administration, Higher, and Continuing Education 450 and 451, or consent of instructor. 1 unit.
461. **Administration of Educational Programs and Personnel.** Study of principles and criteria for analysis of programs at various levels of operation, such as instructional departments and pupil personnel service units, individual schools, local school systems, intermediate units, state education departments, and the federal government. Administration, Higher, and Continuing Education 461, 462, and 463 constitute the required core program for all students specializing in educational administration who are candidates for a degree beyond the master's. Prerequisite: Administration, Higher, and Continuing Education 450, and 430 or 440. 1 unit.
462. **Organization and Business Administration of Public Education.** Organization and operation of public school government; functions and processes of school business administration, including internal organization of the division of business services; and scope and role of the business manager, budgetary process, accounting and financial reporting, contracts, liability, insurance, purchasing, auxiliary services, salary policies, and methods of survey, evaluation, and planning. Prerequisite: Administration, Higher, and Continuing Education 450, 430 or 440, and 461. 1 unit.

- 463. The Role of Administrative Leadership.** Study of principles underlying administrative leadership drawn from such disciplines as philosophy, psychology, sociology, and public administration; application of these principles in the analysis and formulation of general procedures by which the process of administration may be carried on most effectively to develop and operate efficient educational programs. Prerequisite: Administration, Higher, and Continuing Education 461; Educational Psychology 413 or Administration, Higher, and Continuing Education 467. 1 unit.
- 464. Directed Field Experience in Administration.** Direct experience in the study of educational problems of concern to administrators; features an action component whereby the student is provided with opportunities for assuming responsibility for decision making in a live or simulated setting; each student works under the supervision of a professor, and where possible and appropriate, a practicing administrator. 1 to 3 units. No more than 1 unit earned at the master's level.
- 465. Personnel Administration.** Principles, problems, and trends in the administration of professional public school personnel; organization of personnel; assessment and definition of personnel needs; recruitment, selection, and induction; evaluation; personnel development programs; and teacher organizations. Prerequisite: Administration, Higher, and Continuing Education 430, 440, and 450. 1 unit.
- 466. Public School Finance.** Advanced graduate study of the theory and technology of public school finance; attention centered on analysis of principles and theory underlying fiscal practice in various states; technical knowledge of designing controls, organization, and fiscal systems in harmony with expressed theory; and the application of research to the analysis of problems related to the improvement of financing public schools. Prerequisite: Admission to advanced graduate program in the Department of Administration, Higher, and Continuing Education, or consent of instructor. 1 unit.
- 467. Foundations for Group Processes for Administrators.** Laboratory course in which members study group process through involvement in the class as a group; a text, related readings and relevant reports are used to guide critical study of the ethical, sociopsychological, and methodological ideas and problems underlying management and the improvement of groups; special attention is given to the function of group leadership in educational settings. Prerequisite: Administration, Higher, and Continuing Education 450; Educational Psychology 311 and 312. 1 unit.
- 468. School-Community Relations.** Study of the relationship of the American school to the community; analysis of the power structure, social agencies, school liaison groups, and economic character of the community as they affect and are affected by the school; and evaluation of the various media of communication between the school and the larger community, and the development of criteria for an effective program of school-community relations. 1 unit.
- 469. Legal Basis of School Administration.** Legal rights, privileges, responsibilities, immunities, and authority of pupils, parents, teachers, administrators, and school board members in relation to the school. 1 unit.
- 470. Educational Facilities Planning.** Study of concepts and techniques for determining physical needs within the larger environmental context and for translating educational requirements into design criteria; emphasis on the planning process in relation to (1) community and social considerations, (2) pupil population forecasting, (3) program analysis and performance specification development, and (4) the creation of environments conducive to learning. Prerequisite: Administration, Higher, and Continuing Education 450. 1 unit.
- 474. The American College and University.** Introduction to higher education as a subject: its history, purposes, leaders, and literature; attention to conceptual framework in which further development of this subject can progress. 1 unit.
- 475. Administration of Higher Education.** Administrative practices, procedures, and arrangements for policy implementation in the American college (including the community college) and university; special attention given to the roles of major administrative

- officers. Prerequisite: Administration, Higher, and Continuing Education 442 or 474, or equivalent. 1 unit.
477. **Student Personnel Work in Higher Education.** Study of theoretical foundations and principles underlying the practice of student personnel work; investigation of the role and function of student personnel workers in terms of their relationship to various goals, philosophies, issues, trends, and research. 1 unit.
478. **The Administration of Student Personnel Work.** Structural arrangements for meeting student-oriented needs in the American college (including the junior college) and university; attention to the role of the chief administrative officer for student affairs. Prerequisite: Administration, Higher, and Continuing Education 477 or equivalent. 1 unit.
479. **Organization and Control of Higher Education.** Organizational patterns whereby colleges and universities seek to accomplish their purposes; agencies involved in the control of higher education. Prerequisite: Administration, Higher, and Continuing Education 442 or 474, or equivalent. 1 unit.
480. **Internship in the Administration of Higher Education.** Designed to provide supervised direct experience in the administration of higher education; with the aid of the faculty, students select the institution and position most relevant to their career goals. Prerequisite: Consent of instructor. 1 unit. No more than 2 units may be offered toward an advanced degree.
483. **Societal Context of Continuing Education.** Analysis of the continuing education agency as a social system; includes learning group, planning committee, organizational relations with parent institution, and linkage with community; recommended for majors in continuing education. Prerequisite: A basic graduate course on social systems (such as Educational Psychology 413, Educational Policy Studies 315 or 385, Sociology 456 or 492, or Psychology 355). 1 unit.
484. **Continuing Education Internship.** Supervised field experience. Prerequisite: Consent of instructor. 1 to 2 units. May be repeated to a maximum of 4 units.
485. **Continuing Education Agency Administration.** Organization and administration of continuing education programs for adults; decision making, policy, finance, personnel, program, and community relations; analysis of theory, research, and practice; and emphasis on case analysis. Recommended for majors in continuing education. Prerequisite: Administration, Higher, and Continuing Education 483 and a basic administration course (such as Administration, Higher, and Continuing Education 450 or 479, Vocational and Technical Education 489, Library Science 405, or Business Administration 401). 1 unit.
486. **Continuing Education Advanced Seminar.** Analysis of specialized topics related to continuing education of adults; for advanced students. Recommended for majors in continuing education. Prerequisite: Consent of instructor. ½ or 1 unit. May be repeated to a maximum of 3 units.
490. **Seminar for Advanced Students of Education.** Open only to persons who have been admitted for doctoral study in the Department of Administration, Higher, and Continuing Education. Prerequisite: Consent of instructor. 1 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; students are expected to present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Prerequisite: Consent of instructor. 1 to 2 units.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations 497, Social Work 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Individual direction of research and thesis writing. Prerequisite: Admission as a doctoral candidate in the Department of Administration, Higher, and Continuing Education. 0 to 4 units (summer session, 0 to 2 ½ units).

ADVERTISING

Head of Department: Professor S. W. Dunn

Department Office: 103a Gregory Hall, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
281. **Introduction to Advertising.** A survey of the economics, psychology, and philosophy of advertising; preparation of advertisements; selection of media; and organizational structure. Prerequisite: Sophomore standing. 3 hours.
288. **Sales Writing.** Same as Business and Technical Writing 271. Direct mail campaigns and company magazine copy. Prerequisite: Sophomore standing. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in advertising for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Written research proposal and consent of head of department. 2 or 3 hours.
309. **Public Relations.** Publicity methods and public relations; representation of profit and nonprofit institutions to the public; use of communications research and media; and preparation of public relations campaigns. Prerequisite: Junior standing in the College of Communications; consent of department. 3 hours or ½ unit.
381. **Advertising Research Methods.** Quantitative techniques and research methodology in advertising; philosophy of science, statistical methods, survey and experimental design, etc; emphasis on the problems of advertising research. Prerequisite: Advertising 281; junior standing; a specified course in statistical methods; consent of department. 3 hours or ½ unit.
382. **Advertising Creative Strategy and Tactics.** Theory and practice of advertising message planning and creation for print and broadcast media; use of consumer and market surveys, copytesting methods, and advertising readership studies. Prerequisite: Advertising 281; junior standing; consent of department. 3 hours or ½ unit.
383. **Advertising Media Strategy and Tactics.** Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. Prerequisite: Advertising 281; junior standing; consent of department. 3 hours or ½ unit.
389. **International Advertising and Promotion.** The role of advertising and promotion in international communication and economic development; behavioral science approach to international communication strategy; and comparative analysis of advertising and promotion systems. Prerequisite: Advertising 281; junior standing; consent of department. 3 hours, or ½ or 1 unit.
390. **Advanced Creative Strategy and Tactics.** Advanced work in application of behavioral science and creative process to planning and writing of advertisements. Prerequisite: Advertising 382; consent of department. 2 hours, or ½ or 1 unit.
391. **Advertising Management: Planning.** Analysis of actual advertising situations through the case method and study of how such situations might be met; covers all of the decision making areas of advertising. Prerequisite: Advertising 381, 382, and 383; Business Administration 202; consent of department. 3 hours or ½ unit.
392. **Advertising Management: Strategy and Tactics.** Application of advertising management decision criteria to actual communication problems involving advertisers; development of strategy and tactics. Prerequisite: Advertising 391; consent of department. 3 hours or ½ unit.
393. **Advertising in Contemporary Society.** A study of advertising as an institution and its role in communications, society, our economy, and business. Graduate credit is not given for both Advertising 393 and 481. Prerequisite: Advertising 281; senior standing; consent of department. 3 hours or ½ unit.
481. **Economic and Social Aspects of Advertising.** Same as Communications 481. An examination of advertising as an institution; the economic, social, and legal aspects of advertising with focus on current problems. Graduate credit is not given for both Advertising 481 and 393. Prerequisite: Consent of department. 1 unit

482. **Research Methods in Advertising and Communications.** Same as Communications 482. A treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications; examination of both nonquantitative and quantitative methods. Prerequisite: A basic course in statistical methods; consent of department. 1 unit.
483. **Advertising as Communication.** Advertising messages from the perspective of communication and mass communication theories; application of theory to advertising communication problems. Prerequisite: Consent of department. 1 unit.
484. **Advertising and Consumer Behavior.** An examination of consumer behavior as a means of shaping the communications message; use of the behavioral sciences in creative communication strategy. Prerequisite: Consent of department. 1 unit.
485. **Advertising Planning and Decision Making.** Same as Communications 485. An examination of the theoretical foundations of decision theory as they relate to planning and decision making in advertising; use of decision models in the development of strategies and tactics. Prerequisite: Consent of department. 1 unit.
490. **Special Topics in Advertising.** Prerequisite: Consent of department. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in advertising. 1 to 2 units.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

Head of Department: Professor H. S. Stillwell

Department Office: 101 Transportation Building, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
212. **Aerodynamics, I.** Quasi-one-dimensional flow; conservation of mass, momentum, and energy; steady flow with variable area; steady, constant area flow with friction, heat addition, and mass injection; shock waves; nonsteady, one-dimensional flows; and two-dimensional flow, oblique shock waves, and Prandtl-Meyer waves. Prerequisite: Mechanical Engineering 207; Theoretical and Applied Mechanics 156; credit or concurrent registration in Mathematics 343. 4 hours.
213. **Aerodynamics, II.** Equations of motion for a viscous, heat-conducting fluid; exact solutions of the Navier-Stokes' equations; boundary layer theory; inviscid approximations, vorticity, and circulation; potential flow; solutions of potential flow equations, sources, sinks, and Prandtl-Meyer flow; thin airfoil and slender body theory; and method of characteristics. Prerequisite: Aeronautical and Astronautical Engineering 212. 4 hours.
224. **Flight Structures, I.** Development of fundamental concepts of elasticity as related to stress, strain, equilibrium, compatibility, and material properties; applications to flight vehicle structural problems in unsymmetric bending, torsion, thick-walled cylinders, rotating discs, shear flow, and shear center problems. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 156. 4 hours.
225. **Flight Structures, II.** Energy concepts with applications to indeterminate flight structures, sandwich beams, and shear flow; elastic and plastic buckling of columns and plates; and membrane theory of shells. Prerequisite: Aeronautical and Astronautical Engineering 224. 4 hours.
233. **Aircraft Propulsion.** Study of current and projected aircraft power plants and propulsion systems from the standpoint of operation, efficiencies, and construction; fuels and fuel systems; ignition; combustion; and air compression. Prerequisite: Aeronautical and Astronautical Engineering 212. 3 hours.
241. **Flight Vehicle Design.** Introduction to preliminary design of airplanes, missiles, and space vehicles; further development of concepts in orbital mechanics, hypersonic aerodynamics, and aerodynamic heating. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255; Computer Science 101. 3 hours.

254. **Aerospace Dynamic Systems, I.** Aerospace system components and block diagrams; single degree-of-freedom dynamic and linear feedback control systems; Laplace transforms, time domain, and frequency response techniques; the characteristic equation and stability criteria; and introduction to inertial guidance and analog computers. Prerequisite: Mathematics 345 or 349. 3 hours.
255. **Aerospace Dynamic Systems, II.** Hamilton's principle and Lagrange's equation; fundamentals of orbital mechanics and trajectory optimization; multiple degrees of freedom; dynamic systems and continuous elastic structures; divergence and flutter of lifting surfaces; flight vehicle performance, stability, and control; and large disturbance maneuvers. Prerequisite: Aeronautical and Astronautical Engineering 254. 4 hours.
260. **Aerospace Laboratory, I.** Theory and application of experimental techniques in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255. 2 hours.
263. **Aerospace Laboratory, II.** Design of experiments and application of the various measurement techniques to investigations in aeronautical and astronautical engineering. Special projects may be undertaken by selected students. Prerequisite: Aeronautical and Astronautical Engineering 260. 2 hours.
271. **Principles of Automatic Control.** Steady-state and dynamic properties of servomechanisms and feedback control systems; block diagrams and system equations; Laplace transforms; frequency-response techniques; the characteristic equation, stability criteria, and compensation techniques; and introduction to analog computers and inertial navigation. Prerequisite: Mathematics 345 or 349. 3 hours.
292. **Seminar.** Reports and discussions of recent developments in the fields of aerodynamics, flight mechanics, power plants, structures, and maintenance and operations as related to airplanes, missiles, and space vehicles. Prerequisite: Senior standing. 1 hour.
296. **Honors Project.** A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
303. **The Effect of Space Environment on Satellite Motion.** Free molecule aerodynamics; gravity gradient and solar radiation torques on satellites; interaction of on-board magnetic dipoles with the earth's magnetic field; solar wind; cosmic dust and micrometeoroid torques; lifetime problem and density determination; and utilization of these various environmental effects in satellite attitude control. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **Foundations of Mechanics and Gravitational Theory.** Introduction to the dynamics of particles and of rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectiles relative to earth, and precession of earth's axis. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
311. **Aerodynamics of Compressible Fluids.** Methods of solution of fluid flow problems in subsonic, transonic, and supersonic flight regimes. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
313. **Aerodynamics of Incompressible Fluids.** Governing equations for incompressible flow; vorticity, circulation, and Kelvin's, and Helmholtz's theorems; velocity potential and stream function; three-dimensional steady and nonsteady flows, d'Alembert's paradox, and apparent mass; two-dimensional steady flows, complex potential and velocity, and mapping of flows; two-dimensional airfoils and Joukowski transformation and airfoils; and thin airfoil theory. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
314. **Aerodynamic Heat Transfer.** Thermal boundary layers; turbulent heat transfer; aerodynamic heating; and radiative heat transfer. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or $\frac{3}{4}$ or 1 unit.

316. **Applied Aerodynamics.** Two-dimensional and finite wing theory with emphasis on the mechanisms of lift and drag generation; Reynolds number and Mach number effects; drag analysis; high-lift wing systems; propeller and rotor aerodynamics; control surface design; and application of V/STOL aerodynamics. Prerequisite: Aeronautical and Astronautical Engineering 213 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
317. **Elements of Magnetohydrodynamics.** Equations of magnetohydrodynamics; single-fluid and multiple-fluid models; magnetic interaction parameters; magnetosonic waves; hydromagnetic shock waves; aligned-field and crossed-field flows; theory of characteristics; MHD acceleration generation; and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit.
326. **Theory of Continuous Media.** Introduction to the general theory of continuous media and its application to the theories of elasticity, fluid mechanics, and inelasticity; stress and strain tensors and their invariants; nonlinear equilibrium conditions; the mechanism of deformation of single crystal and polycrystalline media; basic concepts of the structure of matter; thermodynamic considerations; and equations of state and stress-strain relationships with applications. Prerequisite: Consent of instructor. 3 hours or 1 unit.
331. **Properties of Gases.** The fundamental principles of kinetic theory and of classical and statistical thermodynamics are reviewed as a basis for treating gas imperfection, dissociation, chemical reactions, ionization processes, transport properties, and relaxation phenomena. With this base, the fundamental equations of reactive flow are derived and applied to the description of quasi-one-dimensional nozzle flow and shock wave structure. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours or $\frac{3}{4}$ unit.
333. **Electric Propulsion.** Elements of propulsion as applied to deep space missions; physics of ionized gases; plasmadynamics; electrothermal, electromagnetic, and electrostatic acceleration of gases to high velocity; high-impulse thruster design and performance; and the resistojet, arcjet, ion engine, MPD arc, and plasma gun. 3 hours or 1 unit.
334. **Rocket Propulsion and Rocketry.** The basic principles of rocket propulsion and rocketry are treated; propellants and their influence on design of rockets, internal and external ballistics, combustion processes, design of components, guidance problems, flight performance, and rocket testing are discussed in detail. Prerequisite: First course in thermodynamics or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
335. **Air Pollution and Combustion.** Same as Mechanical Engineering 333 and Civil Engineering 358. Natural and man-made pollutants in the atmosphere; fundamentals of stoichiometry, reaction kinetics, and chemical equilibrium as applied to pollutants and their reactions in the air; and all combustion devices which make major contributions to air pollution, and current and possible control techniques for these devices. Prerequisite: Chemistry 102 and Mechanical Engineering 205 or 207, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
351. **Aeroelasticity and Aeroinelasticity.** Advanced fundamental treatment of aerodynamic and dynamic structural phenomena associated with flexible airplanes and missiles; divergence of linear and nonlinear elastic lifting surfaces; effect of elastic and inelastic deformations on lift distributions and stability; elastic flutter of straight and swept wings; equations of disturbed motion of elastic and inelastic aircraft; dynamic response to forces, gusts, and continuous atmospheric turbulence; creep divergence of lifting surfaces; flutter in the presence of creep; and effect of temperature on inelastic divergence and flutter. Prerequisite: Aeronautical and Astronautical Engineering 255. 3 hours or 1 unit.
391. **Special Problems.** Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. Prerequisite: Senior standing in engineering; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit.
414. **Boundary Layer Theory.** Theories of the boundary layer of a compressible fluid and their solutions, laminar and turbulent; boundary layer in hypersonic flows. Prerequisite: Aeronautical and Astronautical Engineering 213. 1 unit.

415. **Wing Theory.** Theoretical analysis of the aerodynamic characteristics of two- and three-dimensional wings and multiple-body systems in subsonic and supersonic flows. Prerequisite: Mathematics 346 or equivalent. 1 unit.
417. **Fundamentals of Gas Kinetics.** Fundamental concepts required to study gas dynamic problems from the viewpoint of kinetic theory; derivation of the Boltzmann equation from classical mechanics; reduced and truncated distribution functions and the BBGKY hierarchy; molecular collisions; flux vectors and equations of change; moment equations; summational invariants; H-theorem and Maxwellian distribution; inclusion of the effect of solid surfaces in kinetic theory; existence theory for the Boltzmann equation; iteration procedures; moment methods; Chapman-Enskog procedure; and first and second approximations to the distribution function, heat flux vector, and stress tensor. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 1 unit.
418. **Theory of Rarefied Gas Flows.** Application of kinetic theory to rarefied gas flow problems; free-molecule flow; near free-molecule flow; linearized problems; and flows with appreciable deviation from equilibrium. Prerequisite: Aeronautical and Astronautical Engineering 417 or Physics 362. 1 unit.
428. **Theory of Large Deformations in Nonlinear Continuous Media.** Fundamental concepts of large deformations in nonlinear elasticity and inelasticity with applications: generalized tensors, finite deformations, stress-strain relations in terms of strain energy functions, solutions of tension, shear and bending problems, finite plane strain, theory of successive approximations, fiber-reinforced beams, plates and cylinders, thermodynamics of deformable media, stability considerations, and constituent relations for inelasticity. Prerequisite: Aeronautical and Astronautical Engineering 326 or equivalent. 1 unit.
429. **Theory of Linear and Nonlinear Viscoelasticity.** Same as Theoretical and Applied Mechanics 429. Fundamental concepts of viscoelasticity with applications: elastic-viscoelastic analogies, creep and relaxation functions, thermomechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, and torsion of nonlinear bars and shells. Prerequisite: Aeronautical and Astronautical Engineering 326 or consent of instructor. 1 unit.
434. **Aerodynamic Heating.** Theory of convective aerodynamic heating in high-speed flow and laminar and turbulent flows; ablation, transpiration cooling, and mass transfer cooling; aerodynamic heating in hypersonic flow, real gas effects, and effect of pressure interactions and vorticity interactions; and heat transfer in rarefied gas flows. Prerequisite: Aeronautical and Astronautical Engineering 414 or equivalent. 1 unit.
438. **Fundamentals of Combustion.** Same as Mechanical Engineering 403. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames, their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; and supersonic burning. Prerequisite: Aeronautical and Astronautical Engineering 213 or Mechanical Engineering 305. 1 unit.
452. **Stochastic Structural Dynamics.** Same as Theoretical and Applied Mechanics 417. Structural dynamics problems treated from a probabilistic point of view; theory of probability and random processes introduced as mathematical tools; response of structures under random excitation is studied in order of increasing complexity; and probability of failure for such structures is discussed. Prerequisite: Aeronautical and Astronautical Engineering 255, Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
453. **Aerodynamic Noise.** Same as Theoretical and Applied Mechanics 418. Mathematical techniques for the analysis of intensity, spectrum, and directivity of noise field in vari-

ous environments; practical examples including jet and rocket engines, propeller and fan, sonic boom, and cabin noise of high speed vehicles. Prerequisite: Graduate standing in engineering, physics, or mathematics. 1 unit.

490. **Seminar.** Presentation by graduate students and staff of current topics in the field of aeronautics. Prerequisite: Graduate standing in aeronautical and astronautical engineering. 0 credit.
493. **Special Problems.** Theoretical and experimental investigations of problems in airplane, missile, and space flight engineering. 1 to 2 units.
499. **Thesis Research.** Research in the various areas of the aeronautical and astronautical engineering sciences. 0 to 4 units.

AFRICAN STUDIES

Chairperson of Program: Professor V. C. Uchendu

Program Office: Room 101, 1208 West California Avenue, Urbana

201. **Elementary Swahili, I.** Same as Swahili 201. Beginning spoken Swahili with minimum of formal grammar; conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.
202. **Elementary Swahili, II.** Same as Swahili 202. Second semester of spoken Swahili; more conversation with a native tutor; and further grammar. Prerequisite: African Studies 201. 5 hours.
205. **Elementary Yoruba, I.** Same as Yoruba 201. An introduction to Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; essentials of formal grammar. All students are required to register for three hours per week in the language laboratory. 5 hours.
206. **Elementary Yoruba, II.** Same as Yoruba 202. Second term of spoken Yoruba, including conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; further formal grammar based on conversational materials. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 205 or consent of instructor. 5 hours.
210. **Introduction to Modern African Literature.** Significant contemporary African writings depicting the history and cultural traditions of African peoples. 3 hours.
222. **Introduction to Modern Africa.** Same as Anthropology, Political Science, and Sociology 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
303. **Intermediate Swahili, I.** Same as Swahili 303. Second-year Swahili with emphasis on developing conversational fluency; some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as Swahili 304. More of second-year Swahili with emphasis on conversational fluency; some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.
305. **Advanced Swahili, I.** Same as Swahili 305. Third-year Swahili with emphasis on conversational fluency and on increased facility in reading Swahili texts, including current newspaper prose and (East) African culture materials. Prerequisite: African Studies 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Swahili, II.** Same as Swahili 306. Third-year Swahili with emphasis on conversational fluency and on increased facility in reading Swahili texts, including current newspaper prose and (East) African culture materials. Prerequisite: African Studies 305 or equivalent. 5 hours or 1 unit.

307. **Intermediate Yoruba, I.** Same as Yoruba 303. Continued study of Yoruba grammar with emphasis on developing conversational fluency; readings on Yoruban culture and current affairs. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 206 or consent of instructor. 5 hours or 1 unit.
308. **Intermediate Yoruba, II.** Same as Yoruba 304. Concentrates on attaining conversational fluency; further readings in Yoruban newspapers and magazines and simpler portions from contemporary Yoruban plays and novels. All students are required to register for three hours per week in the language laboratory. Prerequisite: African Studies 307 or consent of instructor. 5 hours or 1 unit.
450. **Seminar on Selected Topics in African Studies.** Topics vary with the disciplinary focus. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 3 units.

AGRICULTURAL COMMUNICATIONS

Acting Head of Department: Professor J. F. Evans

Department Office: 67 Mumford Hall, Urbana

106. **Functional Writing.** Instruction and practice in functional writing related to unique interests of students in the College of Agriculture; designed primarily to be taken with freshman rhetoric by students with special needs for improvement in their use of English. Restricted to students in the College of Agriculture. 1 to 2 hours.
114. **Agricultural Communications Media and Methods.** Same as Journalism 114. Introduction to print, broadcast, visual, and other major communications media used to convey agricultural information; development of basic skills in communicating through those media. Prerequisite: Completion of rhetoric requirement. 3 hours.
214. **Agricultural Communications Strategy.** Same as Journalism 214. Coordinated approach to planning and carrying out programs of agricultural information and education using a variety of communications media; students apply principles of strategy to actual communications problems of their choice. Prerequisite: Agricultural Communications 114 or consent of instructor. 3 hours.
240. **Photography in Agriculture.** Application of visual communications principles to agriculture using the photograph as medium; emphasizes communicative, creative, and technical aspects. See *Timetable* for approximate cost of materials. Prerequisite: Agricultural Communications 114; consent of instructor. 3 hours.
300. **Special Problems in Agricultural Communications.** Special projects, research, and independent study in agricultural communications. Prerequisite: Agricultural Communications 114 or equivalent; written consent of instructor and authorized departmental approval prior to advance enrollment and registration; not open to students on probation. Specific approval of the associate dean is required in advance of registration for a second and/or third special problems course. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.
320. **Agriculture and Its Publics.** Communications analysis of major interactions between agriculture and other segments of American society. Prerequisite: Six hours of social science. 3 hours or $\frac{3}{4}$ unit.
460. **Teaching of College-Level Agriculture.** Analysis and preparation for the problems encountered in the effective teaching of college-level agriculture and home economics; systems approach, including instructional objectives, preassessment of students, instructional strategies, materials, and student performance evaluation; and detailed study of individual problems supplements class work. Prerequisite: Master's standing. $\frac{1}{2}$ unit.
461. **Extension Communications Management.** Analysis and management of effective ex-

tension communications based on present communication and educational concepts. 1 unit.

AGRICULTURAL ECONOMICS

(Including Rural Sociology)

Head of Department: Professor D. I. Padberg

Department Office: 305 Mumford Hall, Urbana

Agricultural Economics

100. **Introductory Agricultural Economics.** Principles of production, supply, and demand applied to economic problems of agriculture and agriculturally related industries and to decisions in farm management, marketing, foreign trade, and agricultural policy; the role in economic growth of natural resources, population, and capital. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Problems in Agricultural Economics.** Individual research work under the supervision of senior members of the staff in the following fields: agricultural credit and finance; agricultural law; agricultural marketing; agricultural policy; agricultural prices; farm management; land economics; rural organization; and statistical analysis. Students may receive credit for research in preparing for intercollegiate debating and speaking on problems in agricultural economics when such opportunities exist. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval are required prior to advance enrollment and registration. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
203. **Farm Taxation.** Federal, state, and local taxation with emphasis on their application to farm income, farm property, farm property transfers, and agricultural cooperatives; introductory material on the uses and sources of revenue. 2 hours.
220. **Farm Management.** Economic principles applied to management of farms; budgeting; crop and livestock systems; record analysis; financial management; farm leases; and problems in resource appraisal and business reorganization. Field trip required; see *Timetable* for approximate cost. Prerequisite: Agricultural Economics 100 or Economics 101. Three hours credit without home farm problem or 4 hours credit with home farm problem. 3 or 4 hours.
223. **Farm Business Accounting and Organization.** The legal structure of farm business organizations, including individual proprietorships, partnerships, corporations, and land trusts; accounting principles and methods as applied to farm businesses; financial and management analysis from accounting records; and accounting systems commercially available to farm businesses. Prerequisite: Accountancy 101 or 201; Agricultural Economics 203 and 220. 2 hours.
230. **Marketing of Agricultural Products.** Nature of the production, the marketing system, and the market for farm products; functions and services performed; and selected and general problems in pricing major commodities, in choosing outlets, and in expanding the market. Field trip; see *Timetable* for approximate cost. 3 hours.
301. **Economics of Agricultural Development.** The economics of agricultural development and the relationships between agriculture and other sectors of the economy in developing nations; agricultural productivity and levels of living in the less developed areas of the world; and studies of agricultural development in different world regions including

- Africa, Asia, and Latin America. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **Financing Agriculture.** Capital and credit needs of farmers; agencies supplying credit; and problems of borrowers and lenders. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
303. **Agricultural Law.** Relation of common-law principles and statutory law to land tenure, farm tenancy, farm labor, farm management, taxation, and other problems involving agriculture. Prerequisite: Senior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
305. **Agricultural Policies and Programs.** The problems of agriculture as an industry; analysis of past and current federal and state governmental policies and programs affecting agriculture; objectives and development of policies; the use of economic concepts in evaluating possible future agricultural policies and programs; and forces in policy formation. Field trip; see *Timetable* for approximate cost. Prerequisite: Economics 101. 3 hours, or $\frac{3}{4}$ or 1 unit.
312. **Rural Real Estate Appraisal.** Same as Agronomy 312. Valuation methods and value bases of rural real estate; legal aspects of property rights, appraisal theory and procedures, condemnation appraisal, characteristics of the rural land market, soil identification and productivity, and other legal, economic, agronomic, and engineering aspects of real estate valuation. Laboratory field trips, including a practice appraisal; see *Timetable* for approximate cost. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
318. **Land Economics.** Physical, economic, and institutional factors that affect the role of land in economic life; population and resource requirements; principles of land utilization; returns from land; land value; property rights and tenure rights; social controls; and rural and urban land development. Prerequisite: For undergraduates, Economics 101 or equivalent; for graduates, consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
324. **Farm Operation.** Operating costs in farming; analysis of farm jobs; farm work simplification; and selecting power units and equipment for economical operation. Field trips; see *Timetable* for approximate cost. Prerequisite: Agricultural Economics 220. 3 hours, or $\frac{3}{4}$ or 1 unit.
325. **Advanced Farm Management.** The functions of management; effects of goals and values on management decision; use of economic analysis in farm production planning, including resource allocation and valuation; and cost minimization. Prerequisite: Agricultural Economics 220. 3 hours, or $\frac{3}{4}$ or 1 unit.
326. **Professional Farm Management.** Principles of farm management applied to the problems of those managing farms for others as a profession; development of the profession; relationships with clients and farm operators; division of inputs and returns between owner and operator; direct operation of farms with hired labor; case problems; business practices and procedures; and professional ethics. Field trips to farms and professional farm management offices; see *Timetable* for approximate cost. Prerequisite: Credit or concurrent registration in Agricultural Economics 324; Agricultural Economics 325. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Grain Marketing.** Economic and marketing problems in grain; the utilization of grain; pricing arrangements for grain, especially futures markets; inventory management; operational problems at country and interior points; factors affecting grain prices; and seasonal variation in grain prices. Field trips required; see *Timetable* for approximate cost. Prerequisite: Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Livestock Marketing.** Same as Animal Science 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; and evaluation of changes in the industry affecting marketing decisions. Field trip; see *Timetable* for approximate cost. Prerequisite: Economics 101; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.

334. **Marketing of Dairy Products.** Same as Dairy Science 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, markup laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; and expanding markets for dairy products. Inspection trip; see *Timetable* for approximate cost. Prerequisite: Agricultural Economics 230, an elementary marketing course, or 12 hours of dairy science or dairy technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Economics of Food Distribution.** Same as Horticulture 335. Analysis of (a) marketing structure and operation in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; and (c) consumer demand for food. Prerequisite: Economics 101; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
337. **Economic History of American Agriculture.** Same as Economics 337 and History 337. The development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college-level course in basic economics or American history. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **Agribusiness Management.** Fundamentals in demand analysis, forecasting, budgeting, investing, locating facilities, financing, pricing, and merchandising in agricultural businesses; practice in decision making using computer games and case problems of firms. Prerequisite: Accountancy 101 or 201; Economics 101 or equivalent. 3 hours or $\frac{3}{4}$ unit.
340. **Commodity Futures Markets and Trading.** Development of futures trading; operation and governance of commodity exchanges; economic functions of futures trading; operational procedures and problems in using futures markets; public regulation of futures trading; and developmental problems. Field trips required; see *Timetable* for approximate cost. Prerequisite: Economics 101 or equivalent. 3 hours or $\frac{3}{4}$ unit.
341. **Agricultural Economic Statistics.** Graphic presentation; frequency distribution; inference and probability; time series analysis; index numbers; analysis of variance; correlation; and simple and multiple regression as applied to agricultural economics. Prerequisite: Mathematics 111 or 112, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
342. **Agricultural Prices.** A study of the factors affecting prices of agricultural products; longtime cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products; and problems in price analysis and forecasting. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
352. **Economic Development in Latin America.** Same as Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Economic Development in India and Southeast Asia.** Same as Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Economic Development of Tropical Africa.** Same as Economics 354. Types of African economies and growth of the exchange economy; development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental planning, and development projects; and demographic, land tenure, and institutional influences on development. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Family Economics.** Same as Home Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 101 or equivalent; a course in applied statistics; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.

401. **International Comparative Agriculture.** Agricultural and food problems of the world and of selected countries viewed in the world setting; resources and institutional factors affecting production; and national and international policies and plans for developing agricultural production and improving levels of living. Emphasis is given to a comparative approach to agricultural development of countries on different economic levels. 1 unit.
404. **Economics of Agricultural Production.** Evaluation of efficiency in the use of agricultural resources; production relationships within the farm; adaptation of the farm business to uncertainty; production relationship among farms; and location of agricultural production. Prerequisite: Economics 300; Agricultural Economics 341 or consent of instructor. 1 unit.
405. **Economic Policies and Programs Affecting Agriculture.** Economic analysis of state, national, and international policies and programs, including proposed legislation having important bearing on the well-being of farm people. Prerequisite: One semester of graduate work or consent of instructor. 1 unit.
406. **Research Methodology in Agricultural Economics.** Methods of inquiry leading to information which is reliable and relevant to the solution of problems significant in the agricultural economy. Prerequisite: Economics 400 or 401, or a course of comparable level in the basic field related to the student's research. 1 unit.
425. **Farm Management Principles.** Analysis of farm business records; evaluation of measures of efficiency; planning the cropping system for increased income and control of erosion; use of economic information in fitting livestock to the farm plan; efficient use of labor and power; and special research problems in farm organization. Field trip; see *Timetable* for approximate cost. 1 unit.
436. **Problems in Marketing Agricultural Products.** Factors influencing growth of markets; methods of reducing costs and improving marketing processes; activities of government agencies; and cooperative efforts. 1 unit.
441. **Agricultural Statistics.** Sources and methods of collection and analysis of prices and other agricultural statistics; trend fitting, linear and curvilinear multiple correlation, analysis of variance, and sampling. Prerequisite: An elementary course in statistics. 1 unit.
442. **Agricultural Price Analysis.** A study of the methods used to analyze factors affecting agricultural prices; analysis of agricultural prices and price movements with respect to time, space, and form; methods of price forecasting; and role of public and private institutions in price setting. Prerequisite: Economics 300 and Agricultural Economics 341, or equivalent. 1 unit.
470. **Seminar in Family and Consumption Economics.** Same as Home Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 101 or equivalent; a course in statistics; Agricultural Economics 370 or consent of instructor. ½ or 1 unit.
491. **Seminar and Special Topics.** All graduate students majoring in agricultural economics must register in the noncredit section of this course. In addition, students may register for credit for individual research or group instruction on special topics under the supervision of one or more staff members. 0 to 2 units.
499. **Thesis Research.** Individual research under supervision of members of the graduate teaching staff in their respective fields. 0 to 4 units.

Rural Sociology

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
270. **Population and Human Ecology.** Same as Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories of human ecology; and current problems. Prerequisite: Sociology 100; junior standing. 3 hours.

277. **Rural Social Change.** Same as Sociology 277. Social forces retarding or accelerating change (traditions, beliefs, attitudes, innovations, social movements, and social planning) as related to rural social organizations and institutions. Field trip to be arranged; for costs see *Timetable*. Prerequisite: Sociology 100. 3 hours.
343. **Social Change in Developing Areas.** Same as Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies; special attention given to problems of traditional social structure undergoing modernization; and social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, family, and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
378. **Sociocultural Factors in African Economic Development.** Same as Anthropology 378. An examination of the African development environment and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
407. **Techniques in Demographic Analysis.** Same as Sociology 407. The analysis of family formation and dissolution; measures of population movement and distribution; and introduction to the stable population model and to applications in the estimation of demographic measures. Prerequisite: Sociology 388. 1 unit.
477. **Seminar on Community Organization.** Same as Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
487. **Special Problems in Rural Sociology.** Same as Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. $\frac{1}{2}$ or 1 unit.

AGRICULTURAL ENGINEERING

(Including Agricultural Mechanization)

Head of Department: Professor F. B. Lanham

Department Office: 241 Agricultural Engineering Building, Urbana

Agricultural Engineering

126. **Engineering in Agriculture, I.** Consideration of the role of the agricultural engineer in the development of agricultural production facilities; resources for production; material and equipment performance characteristics; livestock production systems; and analysis of system constraints. Prerequisites: Mathematics 120; credit or concurrent registration in Physics 106. 3 hours.
127. **Engineering in Agriculture, II.** Continuation of Agricultural Engineering 126. Field equipment performance characteristics; analysis of machinery systems constraints; and elementary design of equipment systems using concepts of uncertainty, modeling, and optimization. Prerequisite: Agricultural Engineering 126; credit or concurrent registration in Computer Science 101. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
236. **Machine Characteristics and Mechanisms.** Design and development concepts of agricultural machines; analysis and synthesis of tillage, planting, harvesting, and material-handling mechanisms. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 212; credit or concurrent registration in Computer Science 101. 3 hours.

256. **Surveying Agricultural and Forest Lands.** Same as Forestry 256. Basic surveying procedures as applied to practices in soil and water conservation engineering and in forest management and engineering. Prerequisite: Mathematics 114. 2 hours.
277. **Design of Concrete and Steel Structures for Agriculture.** Design of steel and concrete structures as applied to farm buildings and soil and water engineering structures. Prerequisite: Credit or concurrent registration in Civil Engineering 261. 3 hours.
287. **Environmental Control for Plants and Animals.** Application of engineering and biological principles to the art and science of controlling environments for productive animals, plants, and their products. Methods for maintaining environments to meet specific biological requirements are investigated through the integration of engineering principles for environmental control with the thermodynamic properties of animals, plants, and their related biological needs. Prerequisite: Agricultural Engineering 126 and 127. 3 hours.
296. **Honors Project.** A special problem in engineering is selected for bibliographical, theoretical, and/or experimental research. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
298. **Undergraduate Seminar.** Professional engineering concepts; relationship of agricultural engineering to other engineering and agricultural disciplines; and preparation and presentation of an undergraduate thesis proposal. Thesis to be completed in Agricultural Engineering 299. Three-day field trip. Prerequisite: Junior standing in engineering. 1 hour.
299. **Undergraduate Thesis.** The agricultural engineering problem selected in Agricultural Engineering 298 is investigated and a detailed engineering report is prepared. Prerequisite: Agricultural Engineering 298; senior standing in engineering. 2 to 4 hours.
311. **Instrumentation and Measurements.** Same as Mechanical Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; and instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
336. **Design of Agricultural Machinery.** Emphasizes design projects which utilize the principles of machine design, engineering analysis, and functional operation of machinery systems; projects are selected, concepts visualized and tested, and design layouts made; and emphasizes unique aspects of agricultural machinery design in selection of drive trains and material conveyors and in weldment design. Prerequisite: Agricultural Engineering 236; credit or concurrent registration in Mechanical Engineering 224. 3 hours or $\frac{3}{4}$ unit.
340. **Introduction to Applied Statistics.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
346. **Tractors and Prime Movers.** Engineering aspects of design and application of tractors for farm, construction, and military use; thermodynamics of engines, turbines, and other power units; and measurement of power and efficiencies, transmission of power, traction, stability, and hydraulic circuitry. Prerequisite: Mechanical Engineering 209. 3 hours or $\frac{3}{4}$ unit.
348. **The Air Pollution System.** Same as Civil Engineering, Environmental Studies, General Engineering, Geography, Mechanical Engineering, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part

II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.

356. **Soil and Water Conservation Structures.** Hydrology, hydraulics, design, construction, and cost estimation of structures for the conservation and quality control of soil and water; relationship of topography, soils, crops, climate, and cultural practices in the conservation and quality control of soil and water for agriculture. Prerequisite: Credit or concurrent registration in Theoretical and Applied Mechanics 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
357. **Land Drainage.** Design, construction, performance, and maintenance of surface, sub-surface, and open ditch agricultural drainage systems. Prerequisite: Credit or concurrent registration in Theoretical and Applied Mechanics 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
387. **Agricultural Process Engineering.** Principles, design factors, equipment, and controls of systems for drying, refrigerating, reducing, pelleting, blending, cleaning, sorting, and treating agricultural crops and products. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
396. **Special Problems.** Individual investigation and report of any phase of agricultural engineering approved by the department. Prerequisite: Senior standing in engineering. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
400. **Research Orientation.** Discussion of the philosophy and methods of research, thesis preparation, and publication of research findings. 0 credit.
436. **Dynamics of Farm Machine Elements.** Advanced study of the dynamics of farm machine elements with specific reference to functional operation, stresses, and fatigue life. Prerequisite: Agricultural Engineering 236 and 336, or equivalent. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Agricultural Engineering 340 or equivalent. $\frac{3}{4}$ unit.
441. **Advanced Design and Analysis of Biological Experiments.** Same as Agronomy 441. Design and analysis of complex experiments. Confounded factorials, lattice designs, and other incomplete-block experiments are considered from the viewpoint of their characteristics, methods of analysis, and usefulness in biological research. Prerequisite: Agricultural Engineering 440 or equivalent. $\frac{1}{2}$ unit.
446. **Dynamics of Tillage, Traction, and Earthmoving.** Relationship of soil parameters to forces acting on tillage tools, earthmoving components, and traction devices; stress-strain relationships in soil, failure patterns, and pulverization; and speed effects, energy requirements, power trains, and model simulation. Prerequisite: Bachelor of Science degree in engineering or consent of instructor. 1 unit.
490. **Seminar.** Presentation and discussion of current research and literature in agricultural engineering. $\frac{1}{4}$ unit.
496. **Problems in Agricultural Engineering.** Investigation and report on problems in farm machinery, farm power, rural electrification, soil and water control, rural housing, and farm structures. Prerequisite: Consent of head of department. 1 unit.
499. **Thesis Research.** 0 to 4 units.

Agricultural Mechanization

100. **Engineering Applications in Agriculture.** Examples, problems, discussions, and laboratory exercises pointing to present and potential engineering applications in agriculture; emphasis on farm power and machinery, soil and water control, farm electrification,

- and farm structures. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Agricultural Mechanics Shop: Construction Technology.** Selection, use, and maintenance of hand and power tools; shop safety; selection of building and roofing materials; concrete and concrete masonry construction; crop and machinery storage; livestock housing; and farm leveling and erosion control structures. A special ten-week course for students majoring in vocational agriculture who are enrolled in off-campus student teaching. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours.
201. **Agricultural Mechanics Shop: Electrical and Metalwork.** Selection and application of electrical wiring, materials, controls, and electric motors to agricultural lighting, heating, ventilating, and materials-handling problems; metalworking, heat treating, and plumbing; and selection and use of electric arc, inert gas, acetylene, and spot welding. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours.
221. **Farm Power and Machinery Management.** Performance, costs, application, and selection of farm tractors and implements; selection of machinery systems. Prerequisite: Credit in Agricultural Mechanization 100 or, with consent of the instructor, concurrent registration in Agricultural Mechanization 100. 4 hours.
241. **Farm Tractor Power.** Construction and performance of internal combustion engines; power transmission, control, fuel, electrical systems, and hydraulic systems; and analysis of methods and equipment for performance testing. Prerequisite: Physics 101 recommended. 3 hours.
252. **Mechanics of Soil and Water Conservation.** Principles of planning, constructing, and adapting soil conservation and drainage practices for Illinois farms, and the application of surveying to these practices. Lectures, field work, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours.
272. **Farm Buildings.** Requirements of farm buildings; problem analysis and planning; building plans; materials; construction methods; and costs. Lectures, discussions, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours.
281. **Farmstead Mechanization.** Fundamental electric laws; planning electric wiring systems; single-phase motor selection, care, and application; and an introductory study of principles and planning required for materials-handling systems, drying, water pumps and systems, and lighting and ventilation in agricultural production. Prerequisite: Agricultural Mechanization 100 or 201. 3 hours.
299. **Agricultural Mechanization Seminar.** The role of the mechanization of agriculture in society and the part of the individual graduate in this role; directed toward the study of the interplay of developments in agriculture and agricultural mechanization; topics selected from technical and popular journals. A tour of farms, industry, and business is required; see *Timetable* for approximate cost. Prerequisite: Junior standing. 1 hour.
300. **Special Problems.** An agricultural problem with engineering implications is selected for study, investigation, and report wherein a satisfactory solution does not require a background of engineering education. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. Prerequisite: Not open to students on probation; senior standing; written consent of instructor and authorized departmental approval is required prior to advance enrollment and registration. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
321. **Advanced Farm Machinery Management.** Considerations of the costs of operation, time of replacement, and optimum system selection of farm field machinery; effects of timeliness, power and traction limitations, machine reliability, and weather uncertainty. Prerequisite: Agricultural Mechanization 221 or equivalent. 4 hours or 1 unit.
331. **Farm Machinery Technology.** The role of forces, motions, and strengths in the operation and performance of common farm machinery mechanisms; study of mechanism il-

illustrations, machinery testing, service problems, and other aspects of the equipment distribution industry. Prerequisite: Physics 101 recommended. 4 hours or 1 unit.

361. **Development and Function of Family Housing.** Same as Home Economics 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials and structure, economic influences, costs, and adaptations; and personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural mechanization students, no prerequisite). 3 hours or $\frac{3}{4}$ unit.
381. **Electromechanical Agricultural Systems.** Application of electric power and mechanical equipment to livestock production, crop conditioning, and materials-handling systems for efficient use of time, power, and labor; principles of planning materials-handling systems; requirements for environmental control in agricultural production; electric controls circuits; and factors affecting drying, cooling, and processing of crops. Prerequisite: Agricultural Mechanization 281 or graduate standing in agriculture. 3 hours or $\frac{3}{4}$ unit.

AGRICULTURE

Program Administrator: Dean K. E. Gardner

Program Office: 104 Mumford Hall, Urbana

100. **Agriculture in Modern Society.** Analysis of agriculture in contemporary society and introduction to problems and challenges related to agriculture; includes a brief orientation to the University and the College of Agriculture. Required of all freshmen in agriculture. 1 hour.
206. **Cooperative Extension Work.** A study of the history, organization, objectives, programs, and methods of extension work. Prerequisite: Agricultural Communications 114; a course in sociology or consent of instructor. 3 hours.
208. **Cooperative Extension Work: Summer Experience.** Full-time work with extension service programs in selected counties under the direction of either extension advisers in agriculture or home economics, or regional director. Approximate training period is June to August. Salary sufficient to cover maintenance and expenses provided. Term report required. It is recommended that this course be preceded by Agriculture 206 or Home Economics 377. Prerequisite: Consent of instructor. 2 hours. Offered in the summer session only.
299. **International Agriculture Study.** Provides campus credit for approved foreign travel-study of agriculture and related sciences under faculty direction. Prerequisite: Junior standing and consent of instructor; consent of college associate dean's office. 0 to 5 hours.

AGRONOMY

Head of Department: Professor R. W. Howell

Department Office: W-201 Turner Hall, Urbana

101. **Introductory Soils.** The nature and properties of soil including origin, formation, and biological, chemical, and physical aspects. Prerequisite: Chemistry 100 or equivalent. 4 hours.
110. **Plant and Animal Genetics.** Same as Animal Science, Dairy Science, and Horticulture

110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111, or Botany 100 or 101. 3 hours.
121. **Principles of Field Crop Science.** An introductory course; kinds, origin, taxonomy, morphology, and physiological and ecological bases of growth, reproduction, improvement, and utilization of corn, soybeans, small grains, forage crops, and sorghums; cropping and tillage practices and principles; and field-crop production hazards. 4 hours.
290. **Undergraduate Agronomy Seminar.** The course includes reports and discussions of crops and soils research. Prerequisite: Senior standing. 1 hour.
299. **Undergraduate Thesis.** Individual research problems in agronomy under the direction of a faculty member in agronomy. Normally the student enrolls during the summer between the junior and senior years and during the fall semester of the senior year, or during both semesters of the senior year. Recommended for those who plan to do research and/or graduate study. Thesis problems should be discussed with the supervising faculty member in the semester preceding enrollment and must be approved by the Agronomy Undergraduate Thesis Committee before enrollment. A maximum of 5 hours may be counted toward graduation. An approved thesis must be presented for credit to be given. Prerequisite: Junior standing; minimum grade-point average of 4.0; consent of instructor. 2 to 5 hours.
300. **Advanced Special Problems.** Individual problems in crops or soils. Graduate students majoring in agronomy do not receive graduate credit. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; consent of instructor. Approval of the agronomy teaching coordinator is required prior to advance enrollment and registration. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.
301. **Soil Survey with Emphasis on Illinois Soils.** Properties and methods used in distinguishing soils; characteristics and distribution of different soils in Illinois; and the cause of these differences and their influence upon proper soil use and management. Laboratory work includes instruction in mapping soils and the use of soil maps, and field trips to examine representative soils. See *Timetable* for approximate cost. Prerequisite: Agronomy 101 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
303. **Soil Fertility and Fertilizers.** Factors affecting the supply of available major, secondary, and minor elements in soils and their influence on crop production; evaluating fertilizer and lime needs; and fertilizer manufacture, sources, and application methods. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit.
304. **Soil Management and Conservation.** Application of principles of soil management to the solution of land-use and conservation problems; influence of soil characteristics on drainage, erosion control, cropping intensity, water management, and land-use planning. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit.
305. **Biochemical Processes in Soil and Water Environments.** Metabolic processes leading to chemical transformations in soil and water environments; implications for soil fertility and environmental pollution. Prerequisite: Microbiology 100; Chemistry 102. 3 hours or $\frac{3}{4}$ unit.
306. **The Dynamics of Soil Development.** The relationship of soils as complex dynamic bodies to various disciplines important to their understanding, such as geology, geomorphology, chemistry, and ecology; discussion of the importance of having an overall model to help in understanding soils; and two field trips to be arranged. Prerequisite: Agronomy 101, Chemistry 102, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Soil Chemistry.** Emphasis on the inorganic reactions involved in soil development and plant nutrition in soils; topics discussed include colloid systems, properties of water, ion exchange equilibria, plant nutrient forms, and methods of analyses. Prerequisite: Agronomy 101; Chemistry 102. 3 hours or $\frac{3}{4}$ unit.
308. **The Physics of the Plant Environment.** The physics of transport processes in the soil and aerial environment of plants; exchanges of energy and gases in crop canopies and

the retention of flow of water, gases, solutes, and heat in soils. Prerequisite: Physics 102; one semester of calculus. 4 hours or 1 unit.

312. **Rural Real Estate Appraisal.** Same as Agricultural Economics 312. Valuation methods and value bases of rural real estate; legal aspects of property rights, appraisal theory and procedures, condemnation appraisal, characteristics of the rural land market, soil identification and productivity, and other legal, economic, agronomic, and engineering aspects of real estate valuation. Laboratory field trips, including a practice appraisal; see *Timetable* for approximate cost. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
313. **Soil Mineral Analysis.** Specialized analytical procedures for determinations of soil minerals and their properties; mineralogy of soils and relationships to soil genesis and fertility. Prerequisite: Agronomy 101 or consent of instructor. 4 hours or 1 unit. Offered in alternate years.
318. **Crop Growth and Production.** Crop production and management as influenced by environment, plant species, and cropping system; relates plant growth processes to management practices. Prerequisite: Agronomy 101 and 121 or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
319. **Environment and Plant Ecosystems.** Same as Environmental Studies and Forestry 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes; discussion of physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels. Prerequisite: One course in biology, Chemistry 101 or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
320. **Crop Physiology.** The physiological basis of crop plants; how the physiological processes influence potential crop yield and crop production. Prerequisite: Botany 100 or equivalent; one course in organic chemistry or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Forage Crops and Pastures.** Forages, their plant characteristics, ecology, and production; grasslands of farm and range as related to animal production and soil conservation. Prerequisite: Agronomy 121. 3 hours or $\frac{3}{4}$ unit.
323. **Principles of Plant Breeding.** Same as Horticulture 323. Genetic and cytological variation in crop plants; the production and control of such variation in developing varieties and hybrids; and the maintenance of high quality seed stocks. Field trips; see *Timetable* for approximate cost. Prerequisite: Botany 100; Agronomy 110 or equivalent. 4 hours or 1 unit.
326. **Weeds and Their Control.** Weeds, their introduction, methods of dissemination, reproduction, and control; a characterization of the common weeds of the Midwest. Prerequisite: Agronomy 121. 3 hours or $\frac{3}{4}$ unit.
333. **Plant Physiology Laboratory.** Same as Botany 333 and Horticulture 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
350. **Crops and Man.** Interpretations of the role of crop plants in the development of cultures and civilizations; description of crops primarily in terms of their origins, evolution, and influences on man's technology, art, religion, and social and political institutions. Field trip; see *Timetable* for approximate cost. 3 hours or $\frac{3}{4}$ unit.
365. **Digital Computer Methods for Statistical Data Processing.** Same as Computer Science 365. A study of methods for efficient utilization of high-speed equipment in the process-

- ing of statistical data; emphasis on principles of application of computing equipment to the solution of statistical problems. Students are expected to solve problems on the computers. Prerequisite: A course in statistics or statistical methods, or equivalent; any computer science 100-level programming course or consent of instructor. 3 hours or 1 unit.
377. **Diseases of Field Crops.** Same as Plant Pathology 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
400. **Seminar.** Discussions of current literature in crops and soils. Required of all graduate majors in agronomy. Prerequisite: Graduate standing. 0 credit.
402. **The Chemistry of Soil Fertility.** The chemistry of the essential plant nutrients in soils, their reactions, and their quantitative relationship to plant growth. Lectures, discussions, and assigned readings. Prerequisite: Agronomy 101; Chemistry 122. 1 unit. Offered in alternate years.
403. **Genesis, Morphology, and Classification of Soils.** Historical review of soil genesis and classification; morphology and genesis of diagnostic soil horizons and features; soil genesis processes and reactions; classification of soils; and characteristics, geography, and production potentials of major soil groups of the world. Lectures, discussions, and assigned readings. Prerequisite: Agronomy 301 or consent of instructor. 1 unit. Offered in alternate years.
405. **Colloidal Chemistry of Soils.** Soil components, their nature, and their influence on the physical, chemical, biological, and electrokinetic properties of soils. Lectures, discussions, and assigned readings. Prerequisite: Chemistry 340 or equivalent. 1 unit.
411. **Soil Physics.** The derivation and application of the fundamental physical principles and laws which govern the behavior of soils; emphasis on transport phenomena and physical characteristics of soils. Lectures, discussions, and assigned readings. Prerequisite: One year of calculus. 1 unit. Offered in alternate years.
412. **Soil Organic Matter.** Basic considerations in organic matter transformation; geochemistry of organic matter; nature and origin of humic substances; and reactions of organic matter in soils and sediments. Lectures, discussions, and assigned readings. Prerequisite: Consent of instructor. 1 unit. Offered in alternate years.
414. **Physical Chemistry of Clays and Soils.** Same as Mining Engineering 414 and Ceramic Engineering 414. The application of physical-chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 or equivalent, or consent of instructor. 1 unit. Offered in alternate years.
422. **Pasture, Range, and Soil Conservation Research.** Discussion and study of data and literature pertaining to pastures, range, and soil conservation; application of research methods to the evaluation of forage species in the management and utilization of pasture and range and to soil conservation. Prerequisite: Agronomy 121 or 322. 1 unit.
423. **Cytogenetic and Evolutionary Basis of Plant Breeding.** Nature and origin of crop species; genetic and cytogenetic basis for developing special plant materials and the use of such materials in breeding programs; and emphasis on discontinuous variation. Prerequisite: Agronomy 323 or equivalent, or consent of instructor. 1 unit.
424. **Mineral Nutrition of Plants.** Same as Botany 424 and Horticulture 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in the light of metabolic activity and constituency in functional plant compounds; major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
429. **The Evolution of Agricultural Economies.** Same as Anthropology 429 and Geography 429. The problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available ar-

- chaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
431. **Plant Cell Metabolism.** Same as Biology, Forestry, Horticulture, and Plant Pathology 431. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the biochemistry of mature seeds and metabolic processes occurring during seed germination and heterotrophic growth. Meets during the first half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. ½ unit.
432. **Plant Cell Energetics.** Same as Biology, Forestry, Horticulture, and Plant Pathology 432. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the energy coupling processes in plant cells (respiration, photosynthesis, photorespiration); and discusses current literature relating to mechanisms of electron transport, phosphorylation, and carbon fixation. Meets during the second half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. ½ unit.
433. **Environmental Regulation of Plant Growth.** Same as Biology, Forestry, Horticulture, and Plant Pathology 433. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns mechanisms of plant response to the environment, including ion uptake and transport, water relationships, gas exchange, and photosynthesis of whole plants. Meets during the first half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. ½ unit.
434. **Regulation of Plant Development and Reproduction.** Same as Biology, Forestry, Horticulture, and Plant Pathology 434. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the hormonal regulation of growth, development, and reproduction and the metabolism of seed and fruit formation. Meets during the second half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. ½ unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, are considered from the viewpoint of when and how to use them. Prerequisite: Agronomy 340 or equivalent. ¾ unit.
441. **Advanced Design and Analysis of Biological Experiments.** Same as Agricultural Engineering 441. Design and analysis of complex experiments; confounded factorials, lattice designs, and other incomplete-block experiments are considered from the viewpoint of their characteristics, methods of analysis, and usefulness in biological research. Prerequisite: Agronomy 440 or equivalent. ½ unit. Offered in alternate years.
442. **Environmental Plant Physiology.** Same as Botany 442. Lecture course dealing with the interaction of plants and environment at the level of the whole organism, extending to the cell and the community; emphasis on heat and mass transfer, plant and soil potentials, and the effects of light on growth. Prerequisite: Chemistry 131; general physics; general or plant physiology; consent of instructor. 1 unit.
444. **Quantitative Aspects of Plant Breeding.** A study of the theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction, and effectiveness of different selection procedures. Prerequisite: Agronomy 323 and 440, or equivalent. 1 unit.
462. **Origin of Variation in Plants.** Same as Botany 462. Study of the principles of plant evolution; discussion of theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaptation. Prerequisite: Consent of instructor. 1 unit.
493. **Advanced Studies in Agronomy.** Directed and supervised detailed study of selected problems or topics. Prerequisite: Consent of instructor. Study may be in any one of the following fields: (a) soil chemistry; (b) soil fertility; (c) soil physics; (d) soil classifica-

tion and pedology; (e) soil mineralogy; (f) soil microbiology; (g) plant breeding and genetics; (h) plant physiology; (i) weed control; (j) crop morphology; (k) crop production and ecology; or (l) statistical techniques and data processing. $\frac{1}{4}$ to 2 units.

499. Thesis Research. 0 to 4 units.

AIR FORCE AEROSPACE STUDIES

Head of Department: Colonel G. T. Boone

Department Office: 232 Armory, Champaign

111. **The Air Force Role in National Security.** First-year survey designed to familiarize the student with the organization, mission, and history of the United States Air Force as it relates to the total defense structure; examines the decision-making processes, resources, and functions of United States general-purpose military forces and aerospace support organizations. 1 hour.
112. **The Air Force Role in National Security.** Continuation of Air Force Aerospace Studies 111. Examines the decision-making processes, resources, and functions of United States strategic offensive and defensive forces and USAF aerospace support organizations. Prerequisite: Air Force Aerospace Studies 111 or consent of instructor. 1 hour.
121. **Sophomore Theory Course: United States Military Forces in the Contemporary World, II.** A study of the organization of the Department of Defense and the role of the military in national policies. In addition, an analysis of the nature and principles of war is presented. Prerequisite: Air Force Aerospace Studies 112 or consent of professor of aerospace studies. 1 hour.
122. **United States Military Forces in the Contemporary World.** An examination, from a historical and political-science point of view, of the major events of military activity during the last twenty-five years and their effect on future Air Force officers. Prerequisite: Air Force Aerospace Studies 121 or consent of instructor. 1 hour.
231. **National Security Forces in Contemporary American Society, I.** In-depth studies of communication skills and their employment in the Air Force, the military profession, civil-military interactions, defense policies, and strategy. Prerequisite: Air Force Aerospace Studies 122 or consent of professor of aerospace studies. 3 hours.
232. **National Security Forces in Contemporary American Society, II.** In-depth studies of communication skills as used in the Air Force; includes officer classification and assignment systems, strategy and the management of conflict, formulation and implementation of United States defense policy, and defense organization and policy making. Prerequisite: Air Force Aerospace Studies 231 or consent of professor of aerospace studies. 3 hours.
241. **Senior Theory Course: The Professional Officer, I.** A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the military justice system; leadership theory, functions, and practices; management principles and function; problem solving; and management tools, practices, and controls. Prerequisite: Completion of all freshman, sophomore, and junior theory courses or consent of professor of aerospace studies; successful completion of the Air Force Officer Qualification Test and a military physical examination. 3 hours.
242. **Senior Theory Course: The Professional Officer, II.** Continuation of Air Force Aerospace Studies 241. Prerequisite: Completion of all freshman and sophomore theory courses or consent of professor of aerospace studies; successful completion of the Air Force Officer Qualification Test and a military physical examination. 3 hours.

ANIMAL SCIENCE

Head of Department: Professor D. E. Becker

Department Office: 328 Mumford Hall, Urbana

100. **Introduction to Animal Science.** A survey of the livestock and poultry industries with emphasis on the importance of product technology and the basic principles of nutrition, genetics, physiology, and ecology as they apply to the breeding, selection, feeding, and management of beef cattle, horses, poultry, sheep, and swine. 3 hours.
109. **Meat Purchasing and Preparation.** A general approach to the subject of meat utilization with emphasis devoted to the physical and chemical composition, nutritive value, selection, and utilization of meat cuts. When appropriate, field trips are taken to area commercial establishments; see *Timetable* for approximate cost. 2 hours. Offered in alternate years.
110. **Plant and Animal Genetics.** Same as Agronomy, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111, or Botany 100 or 101. 3 hours.
119. **Meat Technology.** Student participation in the transformation of live animals through slaughter and carcass fabrication into food products for human consumption; purchase of personal equipment recommended. Prerequisite: Consent of instructor. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Special Problems.** Individual research in animal science. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.
201. **Livestock Management.** Same as Dairy Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Animal science and dairy science majors do not receive credit for this course. Prerequisite: Animal Science 221 or 325. 5 hours.
202. **Domestic Animal Physiology.** A study of the basic physiology of domestic animals in relation to husbandry practices. Prerequisite: Animal Science 100, Dairy Science 100, or one semester of animal biology, or equivalent. 4 hours.
206. **Light Horse Management.** The horse industry; anatomy, selection, breed types, gaits, nutrition and feeding, breeding and reproduction, health and disease, tack and equipment, training and showing, and housing of pleasure horses. Prerequisite: Sophomore standing. 3 hours.
207. **Companion Animal Management.** Biological management of companion animals emphasizing the dog and cat as well as others such as the rabbit, the bird, and fish; subject matter includes anatomy, breeds and breed types, selection, nutrition, reproduction, genetics, training, health and disease, equipment 2.9 needs, and showing of small animals. 3 hours.
209. **Meat Animal and Carcass Evaluation.** Principles and techniques of meat animal and carcass evaluation and their relationship to current practices in industry; includes demonstrations and student participation. Students planning to enroll in Animal Science 210 and 212 should take Animal Science 209 in their sophomore year. Prerequisite: Animal Science 100. 3 hours.
210. **Meat Selection and Classification.** Characteristics associated with the value of carcasses and wholesale cuts from meat animals; grading and classification. Field trips to meat packing plants are required; see *Timetable* for approximate cost. Prerequisite: Animal Science 209. 2 hours.
211. **Breeding Animal Evaluation.** The application of current scientific tools, methods, and performance programs available to livestock breeders for improving beef cattle, swine,

- sheep, and horses; emphasis on the changing nature of modern breeds of livestock as influenced by selection, economics, and consumer and market trends. Prerequisite: Sophomore standing and credit or concurrent registration in Animal Science 209. 3 hours.
212. **Advanced Livestock Evaluation.** Advanced instruction in evaluating meat animals for slaughter and selection of breeding animals. Laboratory. Prerequisite: Animal Science 209 and 211. 3 hours.
221. **Animal Nutrition.** Same as Dairy Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Animal Science 221 and 325. Prerequisite: Chemistry 102 or equivalent. 4 hours.
230. **Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Dairy Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: One course in chemistry. 3 hours.
299. **Seminar.** Individual oral presentations and written reports by senior students in animal science on subjects related to research in the animal sciences. 1 hour.
301. **Beef Production.** The principles of feeding and management of beef cattle; financial aspects of beef production; and diseases, parasites, and breeding difficulties of beef cattle. Lectures, demonstrations, and discussions. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ or $\frac{3}{4}$ unit).
302. **Sheep Science.** A study of the sheep as a biological entity and of factors which influence its responses; examination of the industry which utilizes the sheep's productive potential and of the role of sheep and the industry in animal agriculture and world welfare. Students may register for 3 hours credit without laboratory, for 4 hours credit with laboratory, or for $\frac{3}{4}$ unit. Prerequisite: Animal Science 221 or equivalent. 3 or 4 hours, or $\frac{3}{4}$ unit.
303. **Pork Production.** The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit.
304. **Poultry Management.** The application of science and technology in solving the breeding, feeding, housing, and various management problems encountered in commercial egg and poultry meat production. Three hours credit without or 4 hours credit with individual study and conference, or $\frac{3}{4}$ unit. Prerequisite: Animal Science 221 or 325, or equivalent. 3 or 4 hours, or $\frac{3}{4}$ unit.
305. **Genetics and Animal Improvement.** Same as Dairy Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Animal Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit).
307. **Environmental Aspects of Animal Management.** Animal-environmental interactions (including thermal, air, microbic, photic, sound, and behavioral factors) as bases for prescribing practical environments for production of animals. Prerequisite: Animal Science 202. Courses in physiology, nutrition, microbiology, and genetics respectively are recommended. 3 hours or $\frac{3}{4}$ unit.
309. **Meat Science.** Fundamental biological principles that influence growth, composition, processing, preservation, and quality of meat and meat products. Prerequisite: Chemistry 102; Microbiology 100 and 101, or 200 and 201. Field trip required; see *Timetable* for approximate cost. 4 hours or 1 unit.
320. **Nutrition and Digestive Physiology of Ruminants.** Same as Dairy Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Animal Science 221. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
325. **Principles of Animal Nutrition.** Principles of animal nutrition and their application to veterinary practice. This course is designed primarily for students in veterinary medicine. Credit is not given for both Animal Science 325 and 221. Prerequisite: Biochemistry 350 and 355. 5 hours or 1 $\frac{1}{4}$ units.
330. **Reproduction and Artificial Insemination of Farm Animals.** Same as Dairy Science 330. The anatomy and physiology of reproduction in farm animals, the principles of ar-

- tificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Dairy Science 100 or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, 2 hours or $\frac{1}{2}$ unit).
332. **Livestock Marketing.** Same as Agricultural Economics 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; and evaluation of changes in the industry affecting marketing decisions. Field trip; see *Timetable* for approximate cost. Prerequisite: Economics 101 or equivalent; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
341. **Human Evolution, II.** Same as Anthropology 341. The principles of human genetics; anthropological aspects of race and race formation; and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 240 or an introductory zoology course, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
346. **Ethology.** Same as Anthropology 346 and Zoology 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or $\frac{3}{4}$ unit.
347. **Ethology Laboratory.** Same as Anthropology 347 and Zoology 347. Laboratory in ethology. Prerequisite: Animal Science 346; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
350. **World Animal Agriculture.** Same as Dairy Science 350. Surveys the role of animal agriculture in various geographic and cultural areas of the world; emphasizes animal, environmental, and resource relationships in the provision of food, fiber, and power for human needs. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Animal Science Graduate Seminar.** Discussion of current literature in animal science. Required of all graduate majors in animal science. Sections offered in animal nutrition, environmental management, meat science and muscle biology, and reproductive physiology. 0 or $\frac{1}{4}$ unit. May be repeated to a maximum of 1 unit.
401. **Animal Bionomics.** Discussion of the current literature and research techniques pertaining to adaptation of domestic animals to their environments. Prerequisite: Animal Science 307 or consent of instructor. $\frac{1}{2}$ unit.
402. **Principles of Sheep and Wool Production.** Basic considerations in sheep and wool production and lamb feeding; reports of research. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
403. **Techniques and Topics in Animal Research.** Discussion and study of literature pertaining to animal research; application of experimental techniques; special topics; and review of research in current problem areas. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
404. **Concepts in Nonruminant Nutrition.** A review of current literature in nonruminant nutrition. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
406. **Physiology of Reproduction.** Same as Zoology 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit.
408. **Laboratory Methods in Physiology of Reproduction.** Same as Zoology 408. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
409. **Muscle Biology.** Microstructure and chemical composition of muscle tissue; chemistry and biosynthesis of muscle and connective tissue proteins; and biochemical aspects of muscle contraction and rigor mortis. Prerequisite: Biochemistry 350 and 355. $\frac{1}{2}$ unit.
410. **Research Methods in Animal Science.** Designed to give students training and experience in research and techniques related to animal nutrition, biological management,

environmental physiology, genetics, meat science, muscle biology, nutritional biochemistry, or reproductive physiology. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated to a maximum of 1 unit.

412. **Advanced Endocrinology.** Same as Dairy Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312 or Zoology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 2 units.
420. **Comparative Protein and Energy Nutrition.** Physiological aspects of protein and amino acids, fats and fatty acids, and carbohydrates as applied to higher animals; includes classification, digestion, absorption, utilization, metabolism, and dietary deficiencies and excesses. Prerequisite: Biochemistry 350 or equivalent and a course in nutrition. $\frac{3}{4}$ unit.
421. **Minerals and Vitamins in Metabolism.** Nutritional implications and metabolic roles of minerals and vitamins in animal metabolism. Prerequisite: Biochemistry 350 or equivalent and a course in nutrition. $\frac{3}{4}$ unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Animal Science 340 or equivalent. $\frac{3}{4}$ unit.
463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Biophysics and Veterinary Medical Science 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, biology, and/or consent of instructor. 1 unit.
481. **Animal Biochemical Laboratory Techniques.** Same as Dairy Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences; isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; and determination of metabolic pathways and processes. Prerequisite: Biochemistry 350 and 355; consent of instructor. 1 unit.
499. **Thesis Research.** 0 to 4 units.

ANTHROPOLOGY

Head of Department: Professor E. Giles

Department Office: 109 Davenport Hall, Urbana

102. **Introduction to Anthropology: The Origin of Man and Culture.** An introduction to and survey of human origins and early man, physical anthropology, race and racism, archaeology, and the beginning of human civilization. Recommended though not required to be taken with Anthropology 103 as a survey of the field of anthropology. Credit is not given for both the Anthropology 102-103 sequence and Anthropology 110. 4 hours.
103. **Introduction to Cultural Anthropology.** Survey of cultural anthropology; deals with the nature of culture and its various aspects including social organization, technology, economics, religion, and language, as these are seen among contemporary primitive or preliterate peoples; and some attention also given to distinctive theoretical approaches and to problems of culture change. Credit is not given for both the Anthropology 102-103 sequence and Anthropology 110. 4 hours.

105. **Introductory World Archaeology.** Using archaeological data, traces our prehistoric heritage and the processes which led to the evolution of agriculture, settled villages, and civilization in many areas of the world; lectures range from *Australopithecus* to *Homo sapiens* and from Sumeria and Egypt to Mexico, Peru, and the United States. 3 hours.
110. **General Anthropology.** A concentrated alternative to the Anthropology 102-103 sequence, introducing fundamental concepts in human biology, prehistory, linguistics, and culture and society through a survey of the whole field of general anthropology. Designed to prepare prospective concentrators and other serious students for more advanced anthropology courses. Credit is not given for both Anthropology 110 and the Anthropology 102-103 sequence. 4 hours.
143. **Biological Bases of Human Behavior.** Same as Home Economics, Psychology, and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
161. **Introduction to Afro-American Studies.** A consideration of the varied historical and social dimensions of black culture and Afro-American communities throughout the New World. 4 hours.
168. **Indian Civilization and Society.** Same as History 168. An introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as History 169. An interdisciplinary introduction to modern South Asian history and society. 4 hours.
173. **Cultural Diversity.** Cultural diversity poses personal problems as well as social issues; surveys various cultures as collective patterns for living and as attempts to create a more human way of life; and examines methods for depicting and interpreting cultural codes of behavior, thought, and feeling, with stress on the uses of ethnography in a world of plural cultures. 3 hours.
174. **American Communities and Their Problems.** An examination of American society and its cultural heterogeneity through the study of selected communities, community problems, and solution alternatives. 4 hours.
183. **Archaeology and the Public.** An examination of the roles of archaeology in society; topics include public service archaeology, colonial and national archaeologies, the role of the archaeologist in Euro-American conceptions of the American Indian, and the archaeologist as creator and dispeller of myths. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Introduction to Language Science.** Same as Linguistics 200. An introduction to the theory and methodology of general linguistics; includes the various branches and applications of linguistics. 3 hours.
210. **Family Relationships.** Same as Home Economics 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; and examination of selected family adjustment problems. 3 hours.
220. **Introduction to Prehistory.** An introduction to the problems of studying past cultures; special attention given to the ranges of techniques available and the adequacy of various methodologies as bases for sound inference about the structure of extinct cultures. Prerequisite: Anthropology 102 or 110, or consent of instructor. 3 hours.
222. **Introduction to Modern Africa.** Same as African Studies, Political Science, and Sociology 222. An interdisciplinary introduction to modern Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
230. **Introduction to Social Anthropology and Ethnology.** An introduction to the anthropological study of contemporary human societies; emphasis on the comparative study of social organization, interpersonal relations, cultural ecology, and processes of sociocultural change, but also includes some consideration of the method and theory of ethno-

- logical field research. Prerequisite: Anthropology 103 or 110, or consent of instructor. 3 hours.
240. **Introduction to Biological Anthropology.** The past and present evolution of man and his populational and individual biological variation; topics include genetic principles relevant to human evolution, primate phylogeny and behavior, fossil evidence for human evolution, and the origin and significance of biological diversity in modern man. Prerequisite: Anthropology 102, 110, or 143; or an introductory life sciences course; or consent of instructor. 3 hours.
244. **Anthropology of Play.** Same as Physical Education 244. The study of human play with emphasis on origin, diffusion, spontaneity, emergence, and diversity; includes functions of play in selected culture groups. Prerequisite: A course in anthropology. 3 hours.
246. **Vertebrate Social Organization.** Same as Psychology, Sociology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
247. **An Introduction to Behavior Genetics: Lecture.** Same as Psychology 247. Examination of relations between genetic mechanisms, population structure, race, and individual differences in behavior; survey of research and future possible behavior-genetic analyses; and applications like genetic counseling. Prerequisite: Psychology 100, 103, or 105, or Biology 100, or Physiology 103; a course in statistics which may be taken concurrently. 3 hours.
250. **Introduction to Primitive Technology.** Introduction to the technology of nonindustrial societies; relationships of technology to society; and influence of social and cultural factors on technological innovation. Ethnographic, historical, and archaeological data are used. 3 hours.
259. **Spanish-Speaking Peoples in the United States.** Introduction to the Spanish-speaking population of the United States, including demography, history, economics, and aspects of the sociocultural milieu; emphasis on Mexican-Americans and Puerto Ricans, although other Spanish-speaking groups are also considered. Prerequisite: Anthropology 103 or 110, or consent of instructor. 3 hours.
260. **Peoples of the World: Introduction to Ethnography.** The study and criticism of ethnographic descriptions of exotic ways of life, both as scientific reporting and as a literary art form. Readings include examples from several major culture areas: Africa, the Americas, the Middle East, Oceania, southern and eastern Asia, and Western civilization. Prerequisite: Anthropology 102, 103, or 110, or consent of instructor. 3 hours.
261. **Afro-American Societies and Cultures.** Designed to examine the breadth of the black Americas in South America, Central America, the Caribbean (including Spanish, Gallic, Dutch, and English subareas), and Canada, with specific comparisons to rural and urban United States; the African slave trade with reference to black-white relations in the trade; the development of Creole cultures in West Africa and in Spain and subsequent cultural elaboration in the New World; conditions of slavery, slave revolts, migrations of black people in the New World; and examination of selected ethnographic material. Prerequisite: Anthropology 102, 103, or 110, or consent of instructor. 4 hours.
262. **Afro-American Styles and Strategies.** Comparative study of Afro-American life-styles and social strategies in the United States and the West Indies; centrally concerned with the contemporary unfolding of Afro-American continuities in the two areas with special attention to the following topics: economic oppression, movements of black self-liberation, and Afro-American creativity and symbolism. Prerequisite: Anthropology 261 or Political Science 245, or consent of instructor. 4 hours.
290. **Individual Study.** Supervised reading and research on anthropological topics chosen by the student with staff approval. Especially (but not exclusively) for students who are preparing for a summer field-work project, or who have some justifiable reason for doing independent study, but who do not qualify for the honors (departmental distinction) courses. May not be taken concurrently with Anthropology 291 or 293. Prerequisite:

site: Junior or senior standing; 12 hours in anthropology; consent of instructor. 2 to 4 hours.

291. **Honors Individual Study.** Individual study and research projects for those students who are candidates for departmental distinction in anthropology. May not be taken concurrently with Anthropology 290. Prerequisite: Senior standing; 4.2 grade-point average in anthropology; consent of instructor. 2 to 4 hours.
293. **Honors Senior Thesis.** Preparation and completion of a senior honors thesis, research paper, or equivalent project for those students who are candidates for high or highest departmental distinction in anthropology. May not be taken concurrently with Anthropology 290. Prerequisite: Senior standing; 4.2 grade-point average in anthropology; consent of instructor. 2 to 4 hours.
300. **Introduction to Linguistic Structure.** Same as Linguistics 300. Introduction to the theory and methodology of the science of linguistics with special reference to phonology and syntax. 3 hours or ½ unit.
307. **Introduction to Mathematical Linguistics.** Same as Linguistics 307. Principles of set theory, logic and formal systems, group theory, and automata theory; introduction to the formal theory of grammars. Prerequisite: Anthropology 300. 3 hours or 1 unit.
315. **Area Studies in Ethnomusicology.** Same as Music 317. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, or American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or ½ unit. May be repeated to a maximum of 12 hours or 2 units.
316. **Introduction to Music of the World's Cultures.** Same as Music 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to methods of collecting and studying music in nonliterate, folk, and Asian high cultures. Primarily for students outside the School of Music. Prerequisite: Anthropology 103 or 110, or consent of instructor. 3 hours or ½ unit.
318. **Anthropological Research Design.** Lecture and laboratory on the application of quantitative and qualitative methods in anthropological research; emphasizes both theoretical and methodological problems in designing field research and analyzing field data. Prerequisite: Anthropology 220, 230, 240, or 260 and a course in statistics; or consent of instructor. 3 hours or 1 unit.
320. **Political Anthropology.** The analysis of political behavior and the comparison of political systems from an anthropological perspective; emphasis on local level political processes and the evolution of governmental forms. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
321. **Social Organization and Structure.** An introduction to anthropological concepts of social organization and structure; considers kinship theory, descent and alliance systems, social stratification, nonkin association, social networks, group identification and boundaries, structural-functional interpretations of society, and the meaning of social or cultural structure. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
322. **Anthropology of Law.** Analyzes the legal systems of several primitive societies, the social context in which such legal systems operate, and the place of such studies in developing a theory of jurisprudence; special attention given to legal changes in the developing nations and to the legal problems of minority populations. Prerequisite: Anthropology 103, 260, or 339, or equivalent. 3 hours, or ½ or 1 unit.
328. **North American Archaeology.** Methods, techniques, and results of archaeology in North America; focuses on divergent approaches to the regional archaeology of North America; and surveys and synthesizes the archaeology of the subcontinent. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
329. **The Philosophy of Social Science.** Same as Philosophy 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.

330. **Processes of Culture Change.** The impact of modern cultures on native peoples, comparative study of the mechanisms underlying the transition to modernity in the new nations, and the psychological and structural aspects of acculturation and urbanization. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
331. **Aboriginal North America.** Deals with three major topics: the nature and structure of aboriginal North America as a cultural province and its ecological base; distinctive and common features of American Indian cultures; and responses to the stresses of white contact. Selected type cultures and their adaptations to varying ecological situations are examined in detail. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
332. **Indians of Lowland South America.** A survey of aboriginal non-Andean peoples in contemporary settings; historical and geographical bases for cultural adaptation and elaboration; and ethnicity, cultural ecology, social organization, ritual, and change in selected areas of Lowland South America. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
333. **South American Indians of the Andean Region.** A survey of Andean cultures at the time of the Spanish conquest, of their subsequent history, and of modern Indian culture in the Andean countries. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
334. **The Structural Study of South American Indian Cultures.** A comparative discussion of cultural systems, including their social, religious, and economic aspects; in general, the better-known peoples of South America are considered. Prerequisite: Anthropology 332 or 333, or consent of instructor. 3 hours or 1 unit.
337. **Behavior Genetics Laboratory.** Same as Psychology 347. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Concurrent registration in Anthropology 247. 2 hours or $\frac{1}{2}$ unit.
339. **Anthropological Theory in Contemporary Perspective.** An exploration of current theory in social and cultural anthropology, with emphasis on examining theories in the light of contemporary ideas about theoretical adequacy and of the historical development of anthropological thought; designed especially for anthropology concentrators and anthropology graduate students. Prerequisite: Anthropology 230 or equivalent. 3 hours or 1 unit.
340. **Human Evolution, I.** Principles of evolution and a survey of the evolution of man and his progenitors from the early primates through the Pleistocene epoch; emphasis on evolutionary theory as applied to man and interpretation of the fossil record. Prerequisite: Anthropology 240 or an introductory zoology course, or consent of instructor. 3 hours or 1 unit.
341. **Human Evolution, II.** Same as Animal Science 341. The principles of human genetics; anthropological aspects of race and race formation; and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 240 or an introductory zoology course, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
342. **Behavior-Genetic Analysis.** Same as Psychology 342 and Zoology 350. Concepts, methods, and problems in the analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240 or Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or $\frac{3}{4}$ or 1 unit.
343. **Introduction to Primate Morphology and Behavior.** Same as Zoology 344. Survey of primate social behavior and the classification, morphology, and distribution of living and extinct species; emphasis placed on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240 or Zoology 246, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
344. **Field and Laboratory Techniques in Biological Anthropology.** Supervised participation in biological anthropology research projects; techniques, methods, and procedures discussed and practiced under actual field or laboratory working conditions. Normally taken concurrently with Anthropology 345. Prerequisite: Anthropology 240 or equivalent.

lent; consent of instructor. 3 hours or 1 unit. May be repeated as topics vary. Usually offered in the summer session only.

345. **Analysis of Research Data in Biological Anthropology.** Analysis, interpretation, evaluation, and organization of field and laboratory data in biological anthropology; preparation of written reports on research. May be taken concurrently with Anthropology 344 or subsequently. Prerequisite: Anthropology 240 or equivalent; consent of instructor. 3 hours or 1 unit. May be repeated as topics vary. Usually offered in the summer session only.
346. **Ethology.** Same as Animal Science 346 and Zoology 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or $\frac{3}{4}$ unit.
347. **Ethology Laboratory.** Same as Animal Science 347 and Zoology 347. Laboratory in ethology. Prerequisite: Anthropology 346; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
348. **The Prehistory of Africa.** The study of cultural development in Africa from the appearance of hominids to the time of European domination. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
349. **South American Culture History, I.** An examination of the factors influencing the initial peopling of South America; the spread and diversification of hunting and gathering economies; and the development and spread of the tropical forest cultural pattern. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
350. **South American Culture History, II.** An examination of the factors leading to the rise of civilization in the central Andes, including the evolution of agricultural systems, the elaboration of technology, and the emergence of extensive and complex political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
351. **Archaeological Surveying: Techniques and Applications.** Familiarization with methods used in the location and recording of archaeological sites, including techniques of mapping especially adapted to the needs of archaeology; attention given to means of presenting results and interpreting data derived from this work; and work both in the field and in the laboratory. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
354. **Field Techniques in Archaeology.** Participation in archaeological excavations; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 355. May be repeated as topics vary. Prerequisite: Anthropology 102 or 110, or consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
355. **Laboratory Techniques in Archaeology.** Laboratory work including processing, classifying, dating, interpretation, evaluation, and preparation of written reports of archaeological research. May be taken concurrently with Anthropology 354 or subsequently. May be repeated as topics vary. Prerequisite: Anthropology 102 or 110, or consent of instructor. 3 hours or 1 unit.
356. **Human Osteology.** Identification of human skeletal material and basic techniques of measurement; methods of determining age, sex, race, and stature from the human skeleton; and analysis of skeletal populations. Prerequisite: Anthropology 102 or 110; or a course in anatomy, physiology, or introductory zoology and consent of instructor. 3 hours or 1 unit.
357. **Midwestern Prehistory.** A detailed study of the midwestern archaeological area covering the broad cultures with regional variations considered chronologically and stressing their interrelationships. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **Prehistory of the Old World: Paleolithic and Mesolithic.** Considers the origins of human culture and surveys the development of and relationships among cultural traditions in Africa, Asia, and Europe during the Pleistocene epoch. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
361. **Peoples and Cultures of Mexico and Guatemala.** A survey of the peoples and cultures of middle America with special emphasis upon Mexico and Guatemala; begins by

placing middle America geographically, historically, and culturally within the broader Latin American scene; countries first viewed as a whole and then selected ethnographic studies of specific communities considered for comparative purposes. The Caribbean is not included in this survey. Prerequisite: Anthropology 230 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

362. **Asian Prehistory.** An examination of archaeological data, primarily up to the metal ages, for the major areas of Asia; detailed consideration of developmental, diffusionist, and systems models for explaining these data. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
363. **Religion in Anthropological Perspective.** Same as Religious Studies 363. An introduction to the study of magical and religious beliefs and practices in tribal and peasant societies; considers theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socioreligious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
364. **Field Work in Cultural Anthropology.** Supervised participation in field research in ethnography, ethnology, linguistics, or social anthropology; techniques, methods, and procedures discussed and practiced under actual working conditions. Normally taken concurrently with Anthropology 365. May be repeated as topics vary. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit. Usually offered in the summer session only.
365. **Analysis of Field Data in Cultural Anthropology.** Analysis, interpretation, evaluation, and organization of field data in cultural anthropology; preparation of written reports on research in ethnography, ethnology, linguistics, or social anthropology. May be taken concurrently with Anthropology 364 or subsequently. May be repeated as topics vary. Prerequisite: Anthropology 230 or 300; some knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit.
367. **Cultures of Africa.** Culture and social organization in traditional African societies with emphasis on the politics, kinship, and religion of a small sample of societies illustrating the main cultural variations found in sub-Saharan Africa; some discussion of ecological factors and ethnic group relations in precolonial times. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
368. **Peoples and Cultures of India.** A description and analysis of the social, economic, and religious life of the tribal and peasant peoples of contemporary India considered against the background of Indian geography, population, language distribution, the caste system, and highlights of Indian cultural development. Prerequisite: Anthropology 168 and 230, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Language, Culture, and Society.** Same as Communications 370 and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, or one course in communications or linguistics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
371. **Culture and Personality.** A cross-cultural comparative analysis and evaluation of current theories of culture and personality formation; concerned with the sociocultural matrix in which personality develops as well as with the application of personality concepts to the study of primitive and modern society. Prerequisite: An introductory course in anthropology, sociology, or psychology, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
372. **The Anthropological Study of Art.** A review of the anthropological approach to art with emphasis on structural analysis and the relationship of the artist to his culture; consideration of problems of stylistic development within the framework of cultural dynamics and a survey of the major art styles outside of the Western tradition and the Orient. Prerequisite: Three hours of anthropology or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

373. **Theory and Method in the Cross-Cultural Study of Individual Behavior.** Same as Psychology 373. Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception; emphasis on methodological limitations and contributions of cross-cultural study; and discussion of current problems and research. Prerequisite: Six hours of psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
375. **Mesoamerican Culture History, I.** The origins of complex culture and civilization in Mexico and Guatemala; beginning with the earliest hunting-gathering cultures, examines the processes leading to complex agricultural societies. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.
376. **Mesoamerican Culture History, II.** The major civilizations of Mexico and Guatemala, emphasizing Teotihuacan and the Toltecs, Aztecs, and Maya; examines factors leading to the rise of urbanization and the maintenance and collapse of these civilizations. Prerequisite: Anthropology 375 or consent of instructor. 3 hours or 1 unit.
377. **Social Change in Africa.** Considers problems of social change in Africa from the beginning of the colonial period; topics considered include colonialism in Africa, nationalism, urbanization and labor migration, changing patterns of leadership, and changes in family structure. Prerequisite: Anthropology 230 or consent of instructor. 3 hours or 1 unit.
378. **Sociocultural Factors in African Economic Development.** Same as Rural Sociology 378. An examination of the African development environment and of the social and cultural factors which affect economic development in the African continent. Drawing from case studies and individual country experiences in development, emphasis is placed on the social, cultural, and institutional factors which influence economic decisions at farm, ethnic, national, and regional levels. Prerequisite: A course on Africa or international economic development. 3 hours or 1 unit.
379. **Medical Anthropology: The Culture of Health and Illness.** An introduction to concepts and social aspects of health, illness, and curing in different cultures with consideration also of the interaction between folk and modern medicine in developing nations and the delivery of health care as an international social problem. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours or 1 unit.
380. **Applied Anthropology.** Surveys the role of anthropology in practical affairs and the contributions anthropologists can make in such fields as community development, education, foreign affairs, government, public health, and planning for social or technological change. Prerequisite: Anthropology 230, 260, or 339, or consent of instructor. 3 hours or 1 unit.
381. **Russian Culture History and Ethnology.** Same as Geography 381. An historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or 1/2 or 1 unit.
382. **Siberian Culture History and Ethnology.** Same as Geography 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or 1/2 or 1 unit.
383. **Japanese Culture.** Human lifeways in Japanese settings; emphasis on problems of adapting traditional institutions and behavior patterns to the needs of modern industrial civilization. Prerequisite: Anthropology 230 or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
384. **Traditional Chinese Social Organization.** A descriptive analysis of premodern Chinese culture and society with emphasis on domestic organization, rural and urban social structure, local government, and folk religion; field studies in modern Taiwan and Hong Kong, of the overseas Chinese, and on the mainland used to exemplify particular aspects of Chinese life. Prerequisite: Anthropology 230 or a course in East Asian history, or consent of instructor. 3 hours or 1 unit.
385. **Anthropology of Education.** Same as Educational Psychology 385 and Educational Policy Studies 385. Introduction to the contribution of anthropology to the cross-cul-

- tural study of education, including discussion of material from representative cultures ranging from primitive social groups to present-day national states; education of minority ethnic and subordinate cultures receives special attention; and emphasis on both informal and formal education as a cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
386. **Peoples and Cultures of Mainland Southeast Asia.** The culture, cultural history, and social systems of mainland Southeast Asia: Burma, Thailand, Cambodia, Vietnam, Laos, Assam Hills, upland southwestern China, and Malaya; emphasis on the interaction of complementary ethnic types in the context of local ecology and the Hindu-Buddhist systems of religion and politics of the lowland states. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
387. **Peoples and Cultures of Insular Southeast Asia.** A survey of the cultures and social systems of Indonesia, Malaysia, and the Philippines in the context of the region's history and geographical, economic, political, and religious situation. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours or 1 unit.
388. **Peoples of Oceania I: Basic Pacific Ethnography.** A survey of the peoples inhabiting the Pacific Islands, with emphasis on human ecology and culture history of Australia, Melanesia, Micronesia, New Guinea, New Zealand, and Polynesia; briefly considers the general ethnography of major culture areas, ethnohistory, and contemporary Oceania. Prerequisite: Anthropology 220 or 230, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Peoples of Oceania II: Advanced Pacific Ethnography.** Intensive and detailed study of selected ethnographic reports on peoples from each of the major culture areas of Oceania (Australia, Highland New Guinea, Melanesia, Micronesia, and Polynesia); pro-seminar format stressing student presentations and group discussion. Prerequisite: Anthropology 388 or good preparation in ethnology and social anthropology; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
393. **Laboratory in Primate Social Behavior.** Same as Psychology 393 and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
394. **Advanced Human Osteology.** Comprehensive study of techniques of skeletal identification and restoration, paleopathology and the anthropological interpretation of historic disease patterns, bone growth and development, forensic osteology, demographic reconstruction from osteological data (paleodemography), and dental anthropology. Prerequisite: Anthropology 356 or consent of instructor. 3 hours or 1 unit.
398. **Combined Graduate and Undergraduate Seminar.** A research seminar on specialized topics in anthropology. Prerequisite: Consent of instructor. 4 hours or 1 unit. Students may register in different sections for a total of 8 hours or 2 units; may be repeated in the same semester.
400. **Introduction to General Linguistics.** Same as English as a Second Language 402 and Linguistics 400. Introduction to the linguistic sciences; linguistic theory and methodology; and branches of linguistics and their application. 1 unit. Credit may not be applied toward a graduate degree in linguistics.
429. **The Evolution of Agricultural Economies.** Same as Agronomy 429 and Geography 429. The problems concerning the development of the several basic food crop economies studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
440. **Problems in Physical Anthropology.** A seminar designed to involve students in the theoretical and methodological approaches to problem areas in physical anthropology.

May be repeated for additional credit. Prerequisite: Anthropology 340, 341, or 343; consent of instructor. 1 unit.

443. **Problems in Primate Behavior and Ecology.** Same as Zoology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects; topics vary each semester. Prerequisite: Consent of instructor. ½ or 1 unit. May be repeated for additional credit.
450. **Seminar in Anthropology.** Analysis of selected topics of special interest in anthropology. 1 unit. May be repeated to a maximum of 2 units.
451. **Social Structure.** Intended to deepen training of advanced students in the descriptive techniques and methods of structural and functional analysis currently employed by social anthropologists. Prerequisite: Consent of instructor. 1 unit.
452. **Research Problems in Archaeology.** Seminar oriented to current research problems in archaeology, designed to acquaint students with theoretical and methodological aspects of particular problems and to develop a critical perspective of archaeological research. May be repeated for additional credit. Prerequisite: Consent of instructor. 1 unit.
453. **The Formal Analysis of Kinship Systems.** A survey of a variety of the world's systems of kinship, marriage, and family organization; concentration on the distinctive properties of kinship systems as a species of social structure, on the formal apparatus for describing and understanding them and their functions, and on the theory of kinship that arises from the use of such formal apparatus. Prerequisite: Consent of instructor. ½ to 1 unit.
460. **Theories and Methods in Anthropology.** A seminar identifying, investigating, and evaluating the various theories and trends as well as methods employed by anthropologists. 1 unit.
463. **Seminar on Field Methods and Research Designs in Cultural Anthropology.** Critical examination of field methods and research designs as reflected in selected studies covering the past seventy years, ranging from early missionary reports to those of contemporary field workers; effort made to discern major trends in methodology; and examination of community studies and comparative studies on both the tribal and peasant levels. Prerequisite: Consent of instructor. 1 unit.
489. **Readings in Anthropology.** Individual guidance in intensive readings in the literature of one or more subdivisions of the field of anthropology, selected in consultation with the adviser in accordance with the needs and interest of the student. Prerequisite: One semester of graduate work in anthropology; consent of adviser. ½ or 1 unit.
490. **Individual Topics in Anthropology.** Supervised individual investigation or study of a topic not covered by regular courses. The topic selected by the student and the proposed plan of study are approved by the adviser and the staff member who supervises the work. Prerequisite: Consent of instructor. 1 to 4 units.
499. **Thesis Research.** Preparation of theses. 0 to 4 units.

ARABIC

(See Linguistics under Humanities, School of)

ARCHITECTURE

Head of Department: Professor G. D. Ding

Department Office: 106 Architecture Building, Urbana

101. **Introduction to Environmental Design.** Provides the basis for a critical assessment of present community environments; considers the forces and tools that shape communities; and discusses how better environmental planning, environmental design, and development and redevelopment can help create, preserve, and restore valued qualities in our communities. 4 hours.
171. **Basic Design Studio, I.** An introduction to fundamentals of architectural design: object, perception, and light. Vocabulary: figure-ground composition, balance and movement, proportion and rhythm, mass-space organization, multiple viewing positions, one- and two-point perspective, orthographic projection, and freehand drawing. Prerequisite: Consent of department. 3 hours.
172. **Basic Design Studio, II.** Continuation of Architecture 171. Prerequisite: Architecture 171. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Senior Honors in Architecture.** For candidates for honors in architecture. Independent guided study and research in a selected area of architecture. Prerequisite: Senior standing in architecture, a University grade-point average of 4.0 or, in special cases, approval of the head of the department. 3 hours (summer session, 1 to 3 hours). May be repeated to a total of 6 hours with approval of head of department.
210. **Introduction to the History of Architecture.** Visual and cultural analysis of selected buildings, urban spaces, and cities, from ancient Greece to modern times; emphasizes the architectural traditions of western civilization, especially as they affect the built environment of America and the Middle West. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
220. **Introduction to Architectural Theory.** Overview of the purpose and means of architecture in relation to other human endeavors and the goals of society; professional alternatives; introduction to research, cognitive processes in design, information handling, communication, and evaluation. Prerequisite: Consent of instructor. 3 hours.
231. **Architectural Construction, I.** An introduction to building construction for design professionals. Includes the study of materials, products, and systems for buildings and the criteria for their selection, with emphasis on wood and masonry construction; legal and economic implications and cost control; and written and graphic communications for construction. Prerequisite: Architecture 101 or consent of department. 4 hours.
232. **Architectural Construction, II.** The building process; the architect-engineer, builder, and manufacturer; further study and analysis of materials, products, and systems, with emphasis on noncombustible and fire-resistive building construction; building code and zoning requirements; and specifications. Includes a study of building construction through the preparation of architectural and structural working drawings. Prerequisite: Architecture 231. 3 hours.
241. **Environmental Technology, I.** The integration of environmental control systems in architecture. Includes factors affecting comfort, health, safety, and energy conservation; the fundamentals of atmospheric conditioning of buildings and the equipment and controls systems for varying functions and sizes of buildings; and water supply, waste sewage, and storm-water disposal systems for buildings. Prerequisite: Architecture 232 or consent of instructor. 4 hours.
242. **Environmental Technology, II.** The integration of environmental control systems in architecture. Includes the nature of light illumination and vision, quality and quantity, and sources; integration of illumination and architecture; power distribution systems and equipment; and the nature of sound and architectural acoustics, room acoustics, and sound isolation. Prerequisite: Architecture 232 or consent of instructor. 4 hours.

251. **Statics and Dynamics.** Introduction to basic statics and dynamics with emphasis on architectural applications. Prerequisite: Mathematics 130 and 135; Liberal Arts and Sciences 141 and 142. 4 hours.
252. **Strength of Materials and Design Applications.** Introduction to strength of materials with emphasis on architectural applications. Prerequisite: Architecture 251. 4 hours.
271. **Basic Design Studio, III.** An understanding of the nature of architectural design: form, structure, and function. Vocabulary: architectural scale, aerial perspective, modular construction, isometric projection, circulation, and freehand drawing. Prerequisite: Architecture 172. 3 hours.
272. **Basic Design Studio, IV.** Continuation of Architecture 271. Prerequisite: Architecture 271. 3 hours.
300. **Independent Studies in Urban Design.** The individual study of selected topics involving the history, design, and function of significant European cities. Prerequisite: One year of history of architecture or history of art; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
301. **Independent Study.** Independent guided study and investigation in a selected area of architecture. Prerequisite: Junior standing in architecture, sponsorship by architectural faculty member, and approval of department head. 0 to 4 hours, or 0 to 1 unit.
310. **Ancient Classical Architecture.** The development of architecture and urban design in the ancient Greek world and the Roman Empire. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Early Medieval Architecture.** The architecture and urban design of the Byzantine Empire, Slavic States, Islam, and Western Europe from the Early Christian to the Gothic era. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Gothic Architecture.** The development of architecture and urban design in Europe from the end of the Romanesque period to the Renaissance. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
313. **Italian Renaissance and Baroque Architecture.** The development of architecture, urban design, and garden art in Italy from the early fifteenth century to the late eighteenth century. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **French Architecture, 1500-1800.** The development of architecture, urban design, and landscape architecture in France from the early sixteenth century to the late eighteenth century; French influence in the rest of Europe. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
315. **English and American Architecture.** Major architectural developments in Great Britain in the sixteenth, seventeenth, and eighteenth centuries; regional building traditions; and sources and development of colonial architecture in America. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Architecture of the Nineteenth and Twentieth Centuries.** The development of architecture and urban design in Europe and the Americas from 1800 to the present with special consideration given to the influence of technology and urban conditions. Prerequisite: Architecture 210, or Art 111 and 112, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
317. **The Development of Contemporary Architectural Thought.** An examination of the philosophy of significant architectural writers and architects in relation to their projects and executed work; those studied include Wright, Gropius, Le Corbusier, Mies van der Rohe, Ruskin, Pugin, Blondel, Laugier, Lodoli, Palladio, Alberti, and Vitruvius. Prerequisite: Architecture 210 or Art 111 and 112; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
323. **Social and Behavioral Factors for Design.** A research-oriented introduction to existing social and behavioral knowledge, methods, and tools for relating man to his physical and social environment, with implications for theories and a philosophy of architectural design. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Impact of Technology on Design.** Studies of the effects of emerging technologies upon

the development of the physical environment; examinations of alternative futures. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.

330. **Architectural Practice.** Discussion of the role of the architect, the conduct of professional practice, and professional ethics; office and business procedures; building economics and cost control; contracts and contract documents; legal aspects of professional practice and building construction; and the administration of construction contracts and supervision of construction. Prerequisite: Professional degree candidacy or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
331. **Design Development and Construction Documents.** To be taken with Architecture 373. Network diagram scheduling of professional services; preliminary project investigations of site conditions and facilities, building law, and economic considerations; the integration of materials, structure, mechanical equipment, illumination, and acoustics; design development outline specifications and drawings; the production planning, scheduling, and budgeting for working drawings and specifications; and preparation of portions of these documents. Prerequisite: Architecture 241, 242, and 352; concurrent registration in Architecture 373. 3 hours or $\frac{3}{4}$ unit.
351. **Theory and Design of Metal Structures.** Analysis and design of structures in metal; beams; open-web joists; metal deck; columns; riveted, bolted, and welded trusses; plate girders and connections; lateral loads and bracing; and design of a simple steel frame building. Prerequisite: Architecture 252. 4 hours or 1 unit.
352. **Theory of Reinforced Concrete.** Concrete materials; behavior of reinforced concrete construction; behavior and design of structural elements, one-way slabs, beams, and girders; columns; ACI code requirements; and introduction to continuity in reinforced concrete structures. Prerequisite: Architecture 252. 3 hours or $\frac{3}{4}$ unit.
353. **Reinforced Concrete Design.** Selection, design, and comparison of reinforced concrete floor systems for buildings; study and design of columns and footings; and prestressed concrete. Prerequisite: Architecture 352. 4 hours or 1 unit.
354. **Structural Planning.** General problems in the selection and design of structural systems for buildings; methods of analysis; site explorations, soils, and foundations; bracing; and special systems. Prerequisite: Architecture 351 and 352. 4 hours or 1 unit.
355. **Structural Analysis.** Advanced problems in the analysis of statically determinate structures; general theories and methods of analysis of statically indeterminate structures by geometric and energy methods; and introduction to theory of plastic design. Prerequisite: Architecture 351 and 352. 4 hours or 1 unit.
371. **Architectural Design Studio, I.** Development of skills required in the design and representation of a complete architectural project; exercises in the design of the simplest architectural spaces and elements in relation to their next larger context of site and surroundings. Studio with two theory lectures per week. Prerequisite: Architecture 272 or consent of instructor. 5 hours or $1\frac{1}{4}$ units.
372. **Architectural Design Studio, II.** Design of the simplest building types; relationships within the human habitat at the neighborhood scale; structural and tectonic integration; and ecological and environmental influences. Studio with two theory lectures per week. Prerequisite: Architecture 371. 5 hours or $1\frac{1}{4}$ units.
373. **Architectural Design Studio, III.** Design studies of intermediate-size building types; planned communities; civic and social facilities at the community and urban scale; and collaboration among the several disciplines involved in planning the human habitat: urban planning, landscape architecture, sociology, and economics. Studio with two theory lectures per week. Prerequisite: Architecture 372; concurrent registration in Architecture 331. 6 hours or $1\frac{1}{2}$ units.
374. **Architectural Design Studio, IV.** Research and individual comprehensive design study for a selected architectural project; special emphasis on site development and the integration of construction technology, structure, and environmental systems. Prerequisite: Architecture 331 and 373, or consent of instructor. 6 hours or $1\frac{1}{2}$ units.
379. **Urban Housing.** A study of housing needs, comparative means of financing, comparative building types and costs, and contemporary examples of public and private hous-

ing in Europe and the United States. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.

421. **Environmental Control.** Same as Mechanical Engineering 421. Design of environmental systems for buildings; integration of mechanical, structural, and architectural demand, in lectures and through a semester design project. Prerequisite: Undergraduate degree in architecture or mechanical engineering, or consent of instructor. 1 unit.
430. **Organizational Behavior in the Architectural Process.** Application of the systems approach and organization theory to the study of organizational behavior in the architectural process; the sources and objectives of dynamic change in that process; and the effects of the change. 1 unit.
431. **Advanced Architectural Practice, I.** Comprehensive and critical analysis of that part of professional practice related directly to the construction of buildings; the building industry; policy, organization, procedures, and techniques for construction management; the architect, the owner, and the contractor; and administration of the construction contract. Prerequisite: Architecture 331 or consent of instructor. $\frac{3}{4}$ to 1 unit.
432. **Advanced Architectural Practice, II.** Comprehensive and critical analysis of that part of professional practice related to the organization of the architectural firm and conduct of the internal aspects of business; administrative policy and management functions and procedures; and general development, production, personnel, finance, insurance, accounting, and cost control. Prerequisite: Architecture 331 or consent of instructor. $\frac{3}{4}$ to 1 unit.
434. **Building Economics.** The principles of economics as they apply to individual and large-scale building projects; factors affecting the cost of buildings: the building market, building investment and finance, land acquisition, and the effect of government assistance, leadership, and control; first costs, operating costs, and ultimate costs; cost analysis and cost models; and construction costs, estimates, and cost control. Prerequisite: Architecture 331 or consent of instructor. $\frac{3}{4}$ to 1 unit.
436. **Theory of Materials and Systems Selection.** The principles of decision theory as they apply to the architectural design process in the selection of materials, products, methods, and systems of building construction; factors affecting decision making: function, cost, and aesthetics; and defining the problem, developing alternatives, and final decision. Prerequisite: Architecture 434 or consent of instructor. $\frac{3}{4}$ to 1 unit.
438. **Architectural Problems in Organization Theory.** Individual or group examination and analysis of the application of the theory of complex organizations in the architectural process; analysis of the interaction of architectural and other building organizations as subsystems. Prerequisite: Architecture 430 and Business Administration 409. 1 unit.
439. **Architectural Process Internship.** Individual internship for one summer session or one semester in an approved office of practice in the architectural process; analysis of this work in coordinated university coursework. Residence at the university is not required during internship. Prerequisite: Consent of joint program advisory committee. 1 unit.
451. **Advanced Structural Analysis.** Advanced theory and methods of analysis of statically indeterminate structures; secondary stresses; torsion; buckling and stability; and advanced theory and application of plastic design in building structures. Prerequisite: Architecture 355 or consent of instructor. 1 unit.
452. **Foundation Engineering.** Soil mechanics and site exploration; design of spread footings, combined footings, piles, and caissons; and foundation walls and retaining walls in reinforced concrete. Prerequisite: Architecture 355 or consent of instructor. 1 unit.
453. **Advanced Reinforced Concrete Design.** Critical review of the analysis, methods, and specifications involved in the design and behavior of reinforced concrete structures for buildings, including tall buildings, plates, and shells; computer applications. Prerequisite: Architecture 355; credit or concurrent registration in Architecture 451 or consent of instructor. 1 unit.
454. **Advanced Steel Design.** Advanced topics in the design of steel structures; critical study of the AISC specification; design of steel members and their connections; composite

- structures; and analysis and design of continuous structures and tall buildings. Prerequisite: Architecture 451 or consent of instructor. 1 unit.
455. **Prestressed Concrete Design.** Theory and design of prestressed concrete structures; suspension shell structures. Prerequisite: Architecture 453 or consent of instructor. 1 unit.
456. **Advanced Structural Planning.** Study of the loads, functional and spatial requirements, and construction problems in the selection and design of structural systems for buildings; cost estimates; and integration of mechanical and electrical equipment. Prerequisite: Architecture 452 and 453; credit or concurrent registration in Architecture 454 and 455, or consent of instructor. 1 unit.
471. **Architectural Design Studio, V.** Definitive design of various building types with optional choices related to the student's particular interests, talents, and capacities; emphasis on human need, structural, mechanical, and tectonic integration. Prerequisite: Architecture 374 or consent of instructor. 1 to 2 units.
472. **Architectural Design Studio, VI.** Continuation of Architecture 471. Prerequisite: Architecture 471 or consent of instructor. 1 to 2 units.
476. **Architectural Design Seminar.** Presentations and discussions relative to various areas of architectural and environmental design concerns. Prerequisite: Architecture 374 or consent of instructor. $\frac{3}{4}$ to 1 unit. May be repeated for a maximum of 2 units.
477. **Architectural Design Theory.** A review of principles of architectural design; factors in programming architectural requirements; design development; and evaluation and criticism. Prerequisite: Architecture 374 or consent of instructor. $\frac{3}{4}$ to 1 unit.
478. **Architectural Criticism.** Analysis and criticism of selected buildings; individual reports and discussions. Prerequisite: Architecture 477 or consent of instructor. $\frac{3}{4}$ to 1 unit.
479. **Architectural Design Methods.** Examination of the architectural design process; identification, investigation, and evaluation of design methods. Prerequisite: Consent of instructor. $\frac{3}{4}$ to 1 unit.
481. **Urban Design Studio, I.** Same as Landscape Architecture 481. Design of large building types and building complexes; megastructures; and collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 374; credit or concurrent registration in Urban Planning 384 or consent of instructor. 1 to 2 units.
482. **Urban Design Studio, II.** Same as Landscape Architecture 482. Design development studies of central business districts, movement systems, and residential communities; collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 481, Urban Planning 384, or consent of instructor. 1 to 2 units.
488. **Urban Design Seminar.** Analysis and criticism of urban development projects; individual reports and discussions. Prerequisite: Architecture 374, Urban Planning 384, or consent of instructor. $\frac{3}{4}$ to 1 unit.
491. **Special Problems in Architectural History.** Individual investigation of the work of particular architects, of specific buildings, and of the architecture of periods or regions; comparative studies; and aesthetic problems. Prerequisite: Twelve hours of architectural history or consent of instructor. $\frac{3}{4}$ to 3 units. May be repeated for a maximum of 3 units.
493. **Special Problems in Architectural Administration and Building Construction.** Studies of building projects at large and small scales; investigations in feasibility and cost control, material and system selection, construction techniques and processes, legal and business procedures, and related aspects of professional practice; and independent study or study in conjunction with architectural and urban design projects. Prerequisite: Architecture 331 or consent of instructor. $\frac{3}{4}$ to 3 units. May be repeated for a maximum of 3 units.
495. **Special Problems in Structural Theory and Design.** Individual or group investigation and study in architectural engineering application; research in economy and design in correlation with architectural, mechanical, and structural requirements. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 3 units. May be repeated for a maximum of 3 units.
497. **Special Problems in Architectural Design.** Individual investigation of building types and systems, aesthetic theories, and other problems in architectural design. Prerequisite:

site: Architecture 374 or consent of instructor. $\frac{3}{4}$ to 3 units. May be repeated for a maximum of 3 units.

498. **Special Problems in Urban Design.** Individual investigation of problems at the community and urban scale; collaboration with other disciplines. Prerequisite: Credit or concurrent registration in Architecture 481 or Urban Planning 384, or consent of instructor. $\frac{3}{4}$ to 3 units. May be repeated for a maximum of 3 units.
499. **Thesis Research.** Prerequisite: Consent of instructor and graduate program coordinator. 0 to 4 units. May be repeated for a maximum of 4 units.

ART AND DESIGN

Head of Department: Professor J. R. Shipley

Department Office: 143 Fine and Applied Arts Building, Champaign

105. **Introduction to Watercolor Painting.** Elementary watercolor sketching from landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.
106. **Introduction to Oil Painting.** Elementary oil painting and sketching from still life and landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.
107. **Elementary Drawing.** Practical problems in elementary drawing as applied to solids, line drawing, light and shade, and outdoor and studio sketching. For students not majoring in art. 2 hours. May be repeated for 2 additional hours.
110. **Introduction to Non-Western Art: Africa, the Americas, and Oceania.** Highlights of visual arts traditions in black Africa, pre-Columbian America, and the South Pacific; a cross-cultural analysis of non-Western aesthetic systems and forms with a focus on thematic problems rather than style surveys. 3 hours.
111. **Introduction to Ancient and Medieval Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies previous to the Italian Renaissance. 4 hours.
112. **Introduction to Renaissance and Modern Art.** Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies beginning with the Italian Renaissance and continuing through the Modern period. Prerequisite: Art 111 or consent of instructor for art students. 4 hours.
113. **Orientation to Art.** Information about the various fields of practice in the visual arts, and elementary theoretical concepts; to enrich the student's knowledge of the visual arts and to broaden his appreciation of other art forms. 1 hour.
114. **Orientation to Art.** Continuation of Art 113. 1 hour.
115. **Art Appreciation.** An introduction to the factors inherent in architecture, sculpture, painting, and the other arts. Primarily for nonart students. 3 hours.
116. **Masterpieces of Art.** A presentation of selected masterpieces of the visual arts, both as outstanding documents of culture and as great achievements in art. 2 hours.
117. **Drawing, I.** Theory and practice in the elements of drawing. Open only to students in art and design, theatre design, and interior design. 3 hours.
118. **Drawing, II.** Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 117. 3 hours.
119. **Design, I.** Theory and practice in the elements of design. Open only to students in art and design, theatre design, and interior design. 3 hours.
120. **Design, II.** Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 119. 3 hours.

121. **Drawing Theory.** Orthographic, oblique, and isometric projections and perspective. 2 hours.
122. **Drawing Theory.** Continuation of Art 121. The science of shades and shadows in orthographic, oblique, and isometric projections and perspective. Prerequisite: Art 121. 2 hours.
123. **Fundamentals of Drafting and Drawing.** Drawing techniques, lettering, projections, perspective, and special problems. Primarily for students in occupational therapy and home economics. Prerequisite: Consent of instructor. 3 hours.
125. **Life Drawing.** Prerequisite: Art 118. 2 hours.
126. **Life Drawing.** Prerequisite: Art 125. 2 hours.
129. **Anatomy, I.** Lecture and studio practice in the skeletal and muscular structure of the human figure. Prerequisite: Art 118. 2 hours.
130. **Anatomy, II.** Continuation of Art 129. Prerequisite: Art 129. 2 hours.
131. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 119. 2 hours.
132. **Elementary Composition.** Pictorial composition in line, pattern, and color. Prerequisite: Art 131. 2 hours.
133. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Freshman standing in art. 2 hours.
134. **Design Workshop.** Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Art 133. 2 hours.
135. **Introduction to Photography.** Basic investigation of elements comprising a photograph; exploration of the photogram, tone, and texture as expressive media; and work with the camera, exposure meter, and film and print developing. Work is in black and white. Average cost: \$100 plus cost of required camera. Prerequisite: Freshman standing in art or consent of instructor. 3 hours.
141. **Still Life.** Painting in oil from arranged groups. Prerequisite: Freshman standing in art. 2 hours.
142. **Still Life.** Continuation of Art 141. Prerequisite: Art 141. 2 hours.
150. **Beginning Sculpture.** Clay modeling from the human figure; casting in plaster and other materials as well as production of sculpture involving materials other than plaster and clay. Not open to students majoring in art. 2 hours.
151. **Sculpture.** Anatomical and ornamental forms; plaster molds and models; and wood and stone sculpture. Prerequisite: Freshman standing in art. 2 hours.
152. **Sculpture.** Continuation of Art 151. Prerequisite: Art 151. 2 hours.
159. **Graphic Design: Basic Skills.** Basic production and presentation methods employed by the professional; study of contemporary methodology, drawing techniques, model making, and other processes unique to current professional demands. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. To be taken concurrently with Art 161. 2 hours.
160. **Graphic Design: Production.** Basic information and current methods in the production of multiple printed communications, including printing processes, papermaking, binding and other practices, and the preparation of art work for the various methods of reproduction; field trips required. Prerequisite: Art 159. To be taken concurrently with Art 162. 2 hours.
161. **Graphic Design, I.** Introduction to the discipline and function of graphic design; considers the traditions and potentials of graphic design; and includes practical exercises in visual perception, visual organization, and visual communication. Prerequisite: Sophomore standing in graphic design curriculum or consent of instructor. To be taken concurrently with Art 159 except for students in the industrial design and medical art curricula. 2 hours.
162. **Graphic Design, II.** Introduction to the discipline, function, and tradition of the letter form as it relates to visual/verbal communication; considers both technical and formal aspects of typography. Prerequisite: Art 161 or consent of instructor. To be taken con-

currently with Art 160 except for students in the industrial design and medical art curricula. 2 hours.

175. **Design Methodology.** Introduction to logical methods and systems; review of current theory; investigation of quantitative factors in design; application of systems theory to design problems; short problems; and required reading outside of class. Prerequisite: Sophomore standing in industrial design curriculum or consent of instructor. 2 hours.
176. **Drawing and Rendering.** Emphasis on color and on drawing in perspective; use of pastels, markers, and other media; and quick delineation of industrial objects, interior designs, and architecture. Prerequisite: Sophomore standing in art and design or consent of instructor. 2 hours.
180. **Introduction to Cinematography.** Introduction to the principles and techniques of cinematography as applied to individual expression. 3 hours.
185. **Design.** Composition in line, pattern, monochrome, and color. For nonart majors. 2 hours.
186. **Design.** Continuation of Art 185. For nonart majors. Prerequisite: Art 185. 2 hours.
188. **Individual Projects.** Individually directed projects in various media. Not open to students majoring in art. Prerequisite: Consent of instructor. 2 to 4 hours. May be repeated for a total of 6 hours.
189. **Foundations for Teaching Art.** The study of theories of art and their relationship to the visual arts and to art education theory; includes teaching for appreciation and aesthetic behavior. Prerequisite: Sophomore standing in art education curriculum or consent of instructor. 3 hours.
190. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Credit is not given for both Art 190 and 203. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
191. **Recreational Crafts.** Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Prerequisite: Art 190. 2 hours.
192. **Metalwork and Jewelry, I.** The design and execution of simple jewelry, flatware, and holloware, including study of the characteristics of base and precious metals and stones and working experience in the basic forming, decorating, jointing, and finishing processes. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
193. **Metalwork and Jewelry, II.** Advanced work in the design and production of jewelry, flatware, and holloware with emphasis on the development of related or complicated pieces. Manipulative techniques are expanded and experimentation with materials and processes is encouraged. Prerequisite: Art 192. 2 hours.
194. **Pottery, I.** The design and production of pottery by hand methods. Work covers the basic processes of forming, decorating, and firing. Prerequisite: Sophomore standing or consent of instructor. 2 hours.
195. **Pottery, II.** Advanced work in studio pottery, including expanded experience in forming methods and glaze compounds. Prerequisite: Art 194. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Senior Honors in Art.** For candidates for honors in art. Independent guided study and research in a selected area of art. Prerequisite: Senior standing in art, a University grade-point average of 4.0, and approval of curriculum adviser and head of department. 2 to 5 hours. May be repeated to a total of 5 hours.
201. **Watercolor, I.** Prerequisite: Art 118 and 120. 2 hours.
202. **Watercolor, II.** Continuation of Art 201. Prerequisite: Art 201. 2 hours.
203. **Art in the Elementary Grades, I.** Introductory laboratory experiences with the elements of design in the visual arts and with processes, materials, and activities appropriate for the elementary grades. For nonart students only. Credit is not given for both Art 203 and 190. 3 hours.
204. **Art Education Laboratory.** Art in the elementary and secondary schools; studio activities in a variety of materials and processes appropriate for use in the schools. Prerequisite:

- site: Art 132 or 134, or consent of instructor. 2 to 4 hours. May be repeated to a maximum of 4 hours.
205. **Art in the Elementary Grades, II.** A continuation of laboratory experiences begun in Art 203 with processes, materials, and activities appropriate for the elementary grades. For nonart students only. Prerequisite: Art 203. 3 hours.
 206. **Creative Art for Children.** Theories and techniques of teaching art to children; supervised teaching experience with children required. Prerequisite: Junior standing in art education or consent of instructor. 3 hours.
 207. **Art Curriculum Development and Practicum in the Elementary Schools.** Develops productive and appreciative art curricula for the elementary schools and provides class members with a weekly half-day visitation to the local elementary schools to observe and assist classroom teachers and art consultants in teaching art to children. For art education majors only. Prerequisite: Art 189. 3 hours.
 208. **Organization of Public School Art Programs.** The selection and arrangement of content for different educational levels; study and evaluation of curricula, equipment, and supplies; and program supervision. Prerequisite: Art 207 or junior standing in art, or consent of instructor. 3 hours.
 209. **Japanese Arts Workshop.** The study and practice of the traditional Japanese arts: sumi-e (ink painting), ikebana (flower arrangement), and tea ceremony. Prerequisite: Sophomore standing. 2 hours. May be repeated for a total of 4 hours.
 210. **History of Furniture and Interior Design.** A historical study of furniture and interiors from the Renaissance to the present day; special emphasis upon the American development and the contemporary scene with reference to its technological and historical background. Prerequisite: Sophomore standing. 2 hours.
 211. **The Art of Industrialized Society.** An examination of the art of contemporary Western society in relation to the philosophical, political, and physical forces which produced and were altered by the Industrial Revolution. Prerequisite: Junior standing or consent of instructor. 2 hours.
 212. **Art of the Ancient Near East.** Survey of architecture, sculpture, and painting of the major areas of the Near East before the time of Alexander the Great, focusing on Egypt and Mesopotamia. 3 hours.
 213. **African Art.** An investigation of the characteristics and achievements of outstanding phases of the art of Africa. Prerequisite: One year of history of art or consent of instructor. 3 hours.
 214. **Twentieth-Century European Art.** A survey of the major artists and artistic movements in European painting and sculpture from postimpressionism to the present. Prerequisite: Art 112. 3 hours.
 215. **Basic Photography, I.** Continued exploration of photography as a creative medium with investigation of light, multiple exposure, reflections, and forms; use of the view camera stressed as a mode of self-expression. Work is in black and white. Most equipment is furnished. Estimated cost: \$100 for supplies. Prerequisite: Art 135. 3 hours.
 216. **Basic Photography, II.** Intermediate study for the use of photography as a tool to express ideas, emotions, etc.; students may relate the photographic image to their specific area of academic study; and stress on personal development of self-expressive attitudes. Estimated cost: \$125 for supplies. Prerequisite: Art 215 or consent of instructor. 3 hours. May be repeated with consent of instructor for an additional 3 hours.
 217. **Greek Art.** Survey of architecture, sculpture, and painting of the Greek world from the geometric period to the beginning of the Christian era. 3 hours.
 218. **Roman Art.** Survey of architecture, sculpture, and painting of the Roman world from republican times to the age of Constantine, with brief treatment of later Roman art leading to Byzantine. 3 hours.
 219. **Italian Renaissance Art.** Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. Prerequisite: One year of history of art or consent of instructor. 3 hours.

220. **Northern Renaissance Art.** Architecture, painting, sculpture, and minor arts of Europe outside Italy in the fifteenth and sixteenth centuries. Prerequisite: One year of history of art or consent of instructor. 3 hours.
221. **Art of the Nineteenth Century.** Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the nineteenth century. Prerequisite: One year of history of art or consent of instructor. 3 hours.
222. **Latin American Art.** A study of the more important phases and periods of the visual arts of Latin America. Prerequisite: One year of history of art or consent of instructor. 3 hours.
223. **Italian Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in Italy in terms of major figures and dominant stylistic tendencies. Prerequisite: One year of history of art or consent of instructor. 3 hours.
224. **Northern European Art of the Seventeenth and Eighteenth Centuries.** An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in the low countries, France, England, and Spain in terms of major figures and dominant stylistic developments. Prerequisite: One year of history of art or consent of instructor. 3 hours.
225. **Intermediate Drawing.** Study from life in drawing media. Prerequisite: Art 126 and junior standing in art. 2 hours.
226. **Intermediate Drawing.** Continuation of Art 225. Prerequisite: Art 225. 2 hours.
231. **Intermediate Composition.** Prerequisite: Art 126, 132, and 142. 3 hours.
232. **Intermediate Composition.** Prerequisite: Art 231. 3 hours.
233. **Advanced Composition.** Prerequisite: Art 226, 232, and 244. 3 hours.
234. **Advanced Composition.** Prerequisite: Art 233. 3 hours.
235. **Illustration.** Problems in the design and execution of book and periodical illustration. Prerequisite: Art 132. 2 hours.
236. **Illustration.** Continuation of Art 235. Prerequisite: Art 235. 2 hours.
243. **Figure Painting.** Painting in oil from the head and full figure. Prerequisite: Art 126 and 142. 2 hours.
244. **Figure Painting.** Continuation of Art 243. Prerequisite: Art 243. 2 hours.
245. **Advanced Painting and Drawing.** Advanced creative study from nature and the model in various painting and drawing media. Prerequisite: Art 226, 232, and 244. 3 hours.
246. **Advanced Painting and Drawing.** Continuation of Art 245. Prerequisite: Art 245. 3 hours.
247. **Special Problems.** Special problems in technique, creative production, and painting philosophy. Prerequisite: Senior standing in painting or consent of instructor. 2 hours.
248. **Special Problems.** Individually assigned studio projects. Students may be permitted to enroll in a maximum of two sections of this course simultaneously with different instructors during any semester. Prerequisite: Junior standing in art or consent of head of department; consent of instructor. 2 to 4 hours. May be repeated for a total of 8 hours.
253. **Intermediate Sculpture, I.** A free, experimental, and creative use of permanent and impermanent sculpture materials; clays, wood, pastelines, and plasters. Prerequisite: Art 152. 2 hours.
254. **Intermediate Sculpture, II.** Special projects in stone carving and malleable sheet metal; lead, copper, brass, and aluminum. Prerequisite: Art 253. 2 hours.
255. **Sculpture Materials and Techniques, I.** Special projects for cast bronze; model preparations, investments, melting, pouring, chasing, and developing of patinas. Prerequisite: Art 152; junior standing in curriculum in sculpture. 3 hours.
256. **Sculpture Materials and Techniques, II.** Special projects in terra cotta; use of various clays; preparation and construction methods; special problems in casting methods and materials; kiln operation; fuels; and glazing. Prerequisite: Art 255. 3 hours.
257. **Advanced Sculpture, I.** Introduction to plastics and welded metals; projects utilizing the special qualities of these materials. Prerequisite: Art 254. 2 hours.

258. **Advanced Sculpture, II.** Projects in permanent materials; special attention given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 257. 2 hours.
259. **Advanced Sculpture Materials and Techniques, I.** Projects in various permanent materials; special attention given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 256. 3 hours.
260. **Advanced Sculpture Materials and Techniques, II.** Continuation of Art 259. Prerequisite: Art 259. 3 hours.
265. **Graphic Design, III.** Visual communication problem solving on an applied level, both exploratory and practical; continued research into the literature of perception, visual signification, and symbology; primarily two-dimensional in emphasis. Prerequisite: Art 160 and 162, or consent of instructor. 3 hours.
266. **Graphic Design, IV.** Continuation of Art 265. Concerned primarily with sequential and three-dimensional graphics such as books, brochures, slides, film, videotape, packaging, and exhibition and display design. Prerequisite: Art 265. 3 hours.
267. **Graphic Design, V.** Research on, and analysis and synthesis of, complex visual problems; emphasis on modular sequence, symbolic systems, and image making for visual communication. Prerequisite: Art 266. 3 hours.
268. **Graphic Design, VI.** Continuation of Art 267. Preparation of a comprehensive portfolio and consideration of professional requirements encountered by the designer in the visual communications industry. Prerequisite: Art 267. 3 hours.
269. **Graphic Design Senior Project.** Individually directed project in visual communication emphasizing interdisciplinary approach and research methodology; project definition and structure by student in consultation with advisers. Prerequisite: Senior standing in graphic design curriculum. 2 hours. May be repeated for 2 additional hours of credit.
271. **Materials and Processes, I.** Use and manipulation of basic materials in modern industry. Prerequisite: Junior standing in industrial design curriculum or consent of department. 3 hours.
272. **Materials and Processes, II.** Continuation of Art 271. Prerequisite: Art 271. 3 hours.
275. **Industrial Design, I.** Designing of objects for manufacture by the machine industries. Field trip required. Prerequisite: Junior standing in industrial design curriculum or consent of department. 3 hours.
276. **Industrial Design, II.** Continuation of Art 275. Field trip required. Prerequisite: Art 275. 3 hours.
277. **Advanced Industrial Design.** Prerequisite: Art 276. 5 hours.
278. **Advanced Industrial Design.** Prerequisite: Art 277. 5 hours.
280. **Basic Cinematography.** Fundamentals of the theory and practice of motion pictures as an art form, with emphasis on principles, tools, and techniques. Prerequisite: Art 180 or consent of instructor. 3 hours.
283. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
284. **Printmaking.** A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Art 283. 2 hours.
285. **Lithography.** A studio course in lithography comprised of black and white and multi-color printing on both stones and metal plates; work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Junior standing in art or consent of instructor. 2 hours.
286. **Lithography.** A studio course in lithography comprised of black and white and multi-color printing on both stones and metal plates; work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Art 285. 2 hours.
288. **Glassworking, I.** The design and production of glasswork by the offhand methods;

- work covers the basic processes of blowing and molding. Prerequisite: Art 134; junior standing in art or consent of instructor. 2 hours.
289. **Glassworking, II.** Advanced work in glassworking by the offhand methods including blowing, casting, fuming, and acid etching. Prerequisite: Art 288. 2 hours.
290. **Ceramic Raw Materials.** An introduction to the nature and understanding of basic inorganic raw materials in relation to ceramic processes; laboratory testing of clay types, bodies, slips of earthenware, stoneware, and porcelain temperatures. Prerequisite: Junior standing in curriculum in crafts or consent of instructor. 2 hours. May be repeated for a maximum of 4 hours.
291. **Creative Metalwork Technology.** Understanding of the working properties of a number of nonferrous metals, their alloys, and their patination; such areas as electroforming on organic and inorganic materials, working with rigid and thermosetting plastics, and experimentation with little known processes of metalwork to be subjects of individual research. Prerequisite: Junior standing in crafts or consent of instructor. 2 hours. May be repeated for a maximum of 4 hours.
292. **Introduction to Metal Design in Jewelry.** Emphasis on the basic techniques of cutting, forming, filling, soldering, and finishing of silver and other metals and materials; design emphasis guides toward the development of forms appropriate to creative jewelry. A free and inventive approach to the use of new materials is encouraged, coupled with a respect for the fundamentals of craftsmanship. Prerequisite: Junior standing in curriculum in crafts. 3 hours.
293. **Development of Metal Design in Jewelry.** Greater technical manipulation of tools and materials along with the designing of more complex challenging units of jewelry in silver, gold, and other materials; casting, repousse, and other appropriate techniques serve to develop a greater three-dimensional emphasis. Prerequisite: Art 292. 3 hours.
294. **Ceramic Design, I.** Introduction to ceramic design for developing basic skills in designing and producing clay products by various hand processes including throwing, hand-building, and casting. Prerequisite: Junior standing in curriculum in crafts. 3 hours.
295. **Ceramic Design, II.** Introduction to ceramic glaze calculation; concern with the understanding and application of the knowledge of glaze calculation in a creative way and with applications of creative experiments in glaze and clay bodies. Prerequisite: Art 294. 3 hours.
296. **Decorative Metal Techniques.** Independent personal development in the techniques of chasing, engraving, filigree, inlaying, enameling, and lapidary design with emphasis on linear and textural surface decoration as applied to small metal forms. Prerequisite: Art 293. 5 hours.
297. **Construction of Hollow and Flatware in Silversmithing.** Experimentation and development in silver, bronze, copper, and other metals of hollow forms such as bowls, cups, and tea and coffee servers; work in flatware includes the design and construction of table services and other appointments. Prerequisite: Art 296. 5 hours.
298. **Ceramic Design, III.** The application of the combined skills of throwing and creative glaze procedures to produce thrown ceramic products with the emphasis on creative experimentation; also covers plaster and mold making as a creative procedure in producing clay products. Prerequisite: Art 295. 5 hours.
299. **Ceramic Design, IV.** Technical and creative research in ceramic design, with emphasis on reappraisal of the traditional media and the traditional limited production method used by artist potters. Prerequisite: Art 298. 5 hours.
301. **Greek Painting.** Vase paintings, wall paintings, mosaics, and other examples of the graphic art of the Greek world from Mycenaean times through the Hellenistic period. Prerequisite: Art 217 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
303. **Art of the Eastern and Western Roman Empire.** Deals with monuments outside Italy both in the eastern and western parts of the empire; emphasis on the influence of native traditions and the development of local styles. Prerequisite: Art 218 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

304. **Greek Sculpture.** A survey of the development of Greek sculpture from Mycenaean times to the Christian Era with analysis of the major works in relief and in the round. Prerequisite: Art 217 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
305. **Art of the Augustan Age.** A study of the major works of architecture, sculpture, and painting in Italy and the Roman Empire from the time of Augustus. Prerequisite: Art 218 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Romanesque Art.** Art and architecture of the Romanesque period. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
308. **Early Medieval Art.** The arts of Byzantine and of western Europe from the early Christian Era through the Romanesque period. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
309. **Gothic Art.** The arts of western Europe from the end of the Romanesque period until the Renaissance. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
310. **History of Printmaking.** Variations and artistic developments in fine prints from the fifteenth century to the present; an art historical survey, but emphasis included on techniques, aesthetics, connoisseurship, and personal contact with original examples. Enrollment limited. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **German and Austrian Painting of the Late Nineteenth and Early Twentieth Centuries.** A survey of modern German and Austrian painters and pictorial movements from the 1890s to the period of Hitler, with special emphasis on the expressionist period. Prerequisite: Art 214 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **The Art Nouveau in Europe.** A survey of the principal artists and artistic currents in the applied arts during the 1890s in Europe; emphasis on individual figures, with an attempt to define the common stylistic and theoretical assumptions of the period. Prerequisite: Art 321 or one 300-level course in nineteenth-century art or architecture. 3 hours or $\frac{3}{4}$ unit.
313. **Problems in Italian Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of Italy during the Renaissance selected for intensive study; special emphasis given to the study of the lives of artists and problems in style or iconography. Prerequisite: Art 219 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **Problems in Northern Renaissance Art.** A special field in the history of painting, sculpture, and minor arts of France, Germany, Spain, and England during the Renaissance selected for intensive study; special emphasis given to the study of the lives of the artists and problems in style or iconography. Prerequisite: Art 220 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
316. **Later Chinese Painting.** A study in depth of later phases of Chinese painting, particularly that of the Ming and Ch'ing dynasties; connoisseurship in Chinese painting. Prerequisite: Art 328 or a course in Chinese history of the period covered, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
317. **Italian Art of the Sixteenth Century.** Painting, sculpture, and minor arts in Italy from 1520 to 1590. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
320. **American Art: 1900-40.** Architecture, painting, sculpture, and photography in the United States. Additional work in the form of research papers is required of graduate students. Prerequisite: One year of art history or consent of instructor. 3 hours or 1 unit.
321. **Twentieth-Century Art in Europe: 1900-1914.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on the painting. Prerequisite: Art 214 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Twentieth-Century Art in Europe: 1915-1945.** A study of the leading personalities and movements in European painting, sculpture, and architecture, with emphasis on painting. Prerequisite: Art 214 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
323. **American Art to 1840.** Architecture, painting, sculpture, and minor arts of the colonies and the United States to 1840. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

324. **American Art: 1840-1900.** Architecture, painting, sculpture, and minor arts of the United States. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
325. **Recent American Painting and Sculpture.** Current developments, with special emphasis on works shown in contemporary exhibitions at the Krannert Art Museum. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Art of Medieval Japan.** A study of Japanese art, primarily painting, from the thirteenth century, with emphasis on the work of individual artists. Prerequisite: Art 327 or a course in Japanese history of the period covered, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
327. **Japanese Art.** History of Japanese art from earliest times to the twentieth century. Prerequisite: One year of history of art or junior standing. 3 hours or $\frac{3}{4}$ unit.
328. **Chinese Art.** History of Chinese art from earliest times to the present. Prerequisite: One year of history of art or junior standing. 3 hours or $\frac{3}{4}$ unit.
330. **Oceanic Art.** A survey of traditional art in Polynesia, Melanesia, and Micronesia, including New Zealand and Australia; emphasis on major style areas and their historical and cultural significance. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
331. **West African Art.** A study in depth of West African art styles in time perspective and cultural context, with a special interest in the use of interdisciplinary source materials. Prerequisite: Art 213 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
332. **The Ancient Ideal in Art and Literature.** Same as Classical Civilization 332. A study of the aesthetic standards and theories of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
334. **Old Master Drawings.** An historical and critical survey of drawings from the late Middle Ages to the end of the nineteenth century; emphasis on drawings by artists such as Pisanello, Leonardo, Michelangelo, Raphael, Rembrandt, Rubens, Watteau, Goya, Degas, and Van Gogh. Prerequisite: One year of history of art or consent of instructor. 3 hours or 1 unit.
335. **Romantic Art.** A study of English, French, and German art from the end of the eighteenth century through 1840; focuses on revivalist movements, historicism, landscape art, and changing conceptions of art and artist during the period. Prerequisite: Art 221 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
336. **Realism to Post-Impressionism.** A study of European art from 1850 to 1900, with emphasis on French painting. Prerequisite: Art 221 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
340. **Historiography of Art and the History of Art Criticism.** Origins and the development of the history of art criticism. Prerequisite: A year of study in the history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
341. **Introduction to Art Museology.** Survey of the art museum as a professional institution, its history, and present orientation; designed to acquaint prospective graduate students with the field of museum operation and to serve as background for students entering graduate courses in special fields of art museum practice (museology). Prerequisite: Consent of instructor. 4 hours or 1 unit.
380. **Drawing.** Advanced drawing in several media. Prerequisite: For undergraduates, consent of instructor; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
381. **Painting.** Advanced painting in oil and other media. Not open to candidates for the M.F.A. in painting. Prerequisite: For undergraduates, Art 142 or equivalent; for graduates, consent of departmental graduate committee. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a total of 2 units.
382. **Painting Materials and Techniques.** Study of the materials and techniques used in the various media: oil, watercolor, tempera, gouache, encaustic, etc. Prerequisite: Art 142 or graduate standing in art. 2 hours or $\frac{1}{2}$ unit.

383. **Print Media.** Advanced work in various printmaking techniques. Not open to candidates for the M.F.A. in painting. Prerequisite: For undergraduates, Art 284 or equivalent; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
385. **Lithography.** Laboratory course in lithography. Course of study includes a complete development of the process, exploiting its potential as a fine art medium. Prerequisite: For undergraduates, Art 286; for graduates, consent of departmental graduate committee. 2 hours, or $\frac{1}{2}$ to 1 unit.
387. **Photography.** Emphasis on development of mature creative attitudes through use of personal images and interpretations; work in black and white and in color. Prerequisite: Art 216 or equivalent; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. May be repeated.
388. **Cinematography.** Theory and practice of motion pictures as an art form; emphasis on individual creative production. Anticipated cost to the student for each semester is \$75 to \$200. Costs should be discussed with the instructor before enrollment. Prerequisite: Art 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a total of 12 hours or 4 units.
390. **Advanced Art for Elementary Grades.** Advanced laboratory experiences in two-dimensional visual art techniques for elementary teachers, supervisors, and principals. Prerequisite: Art 205 or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
391. **Advanced Sculpture Techniques.** Advanced work in various sculptural media. Prerequisite: Art 252 or equivalent. 2 hours, or $\frac{1}{2}$ to 1 unit.
392. **Silversmithing, I.** An advanced course in the design and execution of holloware, dealing primarily with raising and spinning methods and with the decorative processes of chasing, repousse, niello, filigree, and inlay. Prerequisite: Consent of instructor. 2 hours, or $\frac{1}{2}$ to 1 unit.
393. **Silversmithing, II.** An advanced course in the design and execution of flatware and holloware, dealing primarily with forging and seaming methods, engraving, and tool-making. Prerequisite: Consent of instructor. 2 hours, or $\frac{1}{2}$ to 1 unit.
394. **Ceramic Design.** Ceramic design with emphasis on the development of professional style and personal expression. Prerequisite: Consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 2 units. May be repeated to a total of 6 hours.
395. **Glass Design.** Advanced glass design with emphasis on professional development and personal style. Prerequisite: Consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
441. **Art Curatorial Techniques.** An intensive course in the role, responsibilities, and duties of the art museum curator; demonstration and practice of curatorial techniques in researching; documenting, acquiring, transporting, handling, and conservation of works of art. Prerequisite: Art 341. 1 unit.
442. **Art Museum Administration and Education.** Two aspects of art museum work: (1) administration, covers trustee relations, methods of serving the public, fund raising, budgeting, staff organization, and program planning; (2) museum education. Students receive practice in the preparation of educational exhibitions and related educational materials. Prerequisite: Art 341. 1 unit. Art 443. Art Museum Internship. Introduction to actual supervised practice in one specialized department in an art museum: curatorial, education, or administration department. Prerequisite: Art 441 and 442. 1 unit.
450. **Seminar in Modern Art.** Investigation of special problems in the history of twentieth-century art. Students present reports of their research. Prerequisite: Consent of instructor. 1 unit.
451. **Seminar in American Art.** Investigation of selected problems in the history of American art. Prerequisite: Art 323 and 324, or consent of instructor. 1 unit.
452. **Seminar in Chinese Art.** Investigation of selected phases, concepts, and problems of the art of China; intensive reading and reports. Prerequisite: Art 328 or consent of instructor. 1 unit.
453. **Seminar in Japanese Art.** Investigation of selected phases, concepts, and problems of

- the art of Japan; intensive reading and reports. Prerequisite: Art 327 or consent of instructor. 1 unit.
454. **Seminar in Ancient Art.** Research seminar in problems selected from the art of the ancient Mediterranean area. Prerequisite: At least one of the following: Art 304, 305, 306, or 307, or equivalent. 1 unit.
455. **Seminar in Baroque Art.** Research seminar in problems selected from the art of seventeenth-century Europe. Prerequisite: Art 319 or 320, or equivalent; or consent of instructor. 1 unit.
456. **Seminar in the Art of the Period 1750-1900.** An intensive study of selected problems in European art. Prerequisite: Consent of instructor. 1 unit. May be repeated to a total of 3 units.
457. **Studies in Medieval Art.** Research seminar in subjects selected from the art and architecture of the medieval period in western Europe. Prerequisite: Art 308 or 309; effective reading knowledge of French or German; consent of instructor. 1 unit.
458. **Seminar: African Art.** An intensive investigation of selected problems in the sculpture and other arts of Negro Africa. Prerequisite: Consent of instructor. 1 unit.
459. **Seminar in Renaissance Art.** Special problems in the history of Renaissance art. Prerequisite: Consent of instructor. 1 unit.
467. **Graphic Design Laboratory.** Individually directed research in the studio with concentration in graphic design. Prerequisite: Enrollment in the M.F.A. program in graphic design or consent of departmental graduate committee. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units. May be repeated to a maximum of 3 units.
477. **Industrial Design Laboratory.** Individually directed research in the drafting room or workshop with concentration on industrial design. Prerequisite: Enrollment in the M.F.A. program in industrial design or consent of departmental graduate committee. $\frac{1}{2}$ to 3 units. May be repeated.
486. **Photography Studio.** Individually directed research; personal expression through the photographic medium. Prerequisite: Enrollment in M.F.A. program and major in photography/cinematography, or consent of the departmental graduate committee. $\frac{1}{2}$ to 2 units. May be repeated for additional credit.
487. **Cinematography Studio.** Individually directed research; expression through the cinematographic medium. Prerequisite: Enrollment in M.F.A. program and major in photography/cinematography, or consent of the departmental graduate committee. $\frac{1}{2}$ to 2 units. May be repeated for additional credit.
489. **Issues in Art Education.** A study of fundamental issues affecting education in the visual arts; examines and explores the educational implications of the nature and value of art, the nature of the artist, and the development of the child as an artist and connoisseur. 1 unit.
490. **Curriculum Development in Art.** An analysis of curriculum organization in the visual arts; particular emphasis given to a range of curriculum positions in education and general research related to curriculum design. Prerequisite: Consent of instructor. 1 unit.
491. **Special Problems.** Individual direction in research and in creative activity; thesis. $\frac{1}{2}$ to 2 units.
492. **Individual Readings in History of Art.** Directed readings in special fields or aspects of history of art not provided in depth by the current course offerings. Prerequisite: Consent of instructor. Sections A and B may be taken simultaneously. Registration allowed for each section is $\frac{1}{2}$ to 1 unit.
493. **Seminar: Introduction to Methods and Criticism.** Prerequisite: Graduate standing in art. $\frac{1}{4}$ to 1 unit.
494. **Seminar: Studies in the Development of Art History and Criticism.** The relation of art history and criticism: changing standards and criteria; intensive reading of selected critical works; and the writing of art criticism. Prerequisite: Consent of instructor. 1 unit.

495. **Painting Laboratory.** Professional and experimental painting with emphasis on the development of maturity of style and personal expression. Prerequisite: Enrollment in the M.F.A. program in painting and printmaking or consent of departmental graduate committee. $\frac{1}{2}$ to 3 units.
496. **Sculpture Laboratory.** Experience at a professional level in sculptural techniques including metals casting, welding, stone carving, wood carving, clay modeling, and ceramic sculpture, with emphasis on the development of creative achievement. Prerequisite: Enrollment in the M.F.A. program in sculpture or consent of departmental graduate committee. 1 to 3 units.
497. **Print Workshop.** Intaglio, relief, and planographic print media; includes etching, engraving, aquatint, wood, paper, and plastic relief printing, and lithography. Prerequisite: Graduate standing in art. $\frac{1}{2}$ to 3 units.
498. **Ceramic-Glass-Metal Laboratory.** Individually directed research and personal expression in ceramic, glass, or metal medium. Prerequisite: Enrollment in the M.F.A. program with a major in ceramics, glass, or metal, or consent of departmental graduate committee. $\frac{1}{2}$ to 2 units. May be repeated.
499. **Thesis Research.** Guidance in research and writing theses for advanced degrees. Prerequisite: Graduate standing in history of art or art education. 0 to 4 units.

ASIAN STUDIES

(Including Chinese, Japanese, Korean, and Sanskrit)

Director of Center: Professor R. B. Crawford

Center Office: Room 201, 1208 West California Avenue, Urbana

All 200-level language courses, Chinese 301 and 302 and Japanese 301 and 302 are open to freshmen.

Asian Studies

161. **Man and Society in East Asia, I.** Same as History 161. A topical approach to the major themes of Chinese and Japanese civilizations through an examination of how people in these civilizations approached basic human and social problems. 3 hours.
162. **Man and Society in East Asia, II.** Same as History 162. Continuation of Asian Studies/History 161. Prerequisite: Asian Studies/History 161. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
290. **Individual Study.** Directed readings in the languages and literatures of East Asia, South Asia, Southeast Asia, or the Near East. The area selected depends on the student's interest. Prerequisite: Consent of instructor. 2 to 4 hours.
298. **Colloquium in Asian Studies.** 3 hours.
303. **Japanese Society.** Same as Sociology 327. The institutions of contemporary Japan and their historical roots; the Japanese approach to modernization and development and social change; implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
345. **Tutorials in East and Southeast Asian Languages.** Tutorials at the elementary, intermediate, and advanced levels in special Asian languages not regularly offered are available with the consent of the director of the Center for Asian Studies. May be repeated up to six semesters successively, but no more than 4 units of graduate credit may be accumulated. Graduate credit is given only for work beyond the elementary level. Prerequisite: Consent of director of the Center for Asian Studies. 5 hours or 1 unit.

390. **Readings in East Asian Literature.** Guided readings in an East Asian literature in the vernacular with regular individual conferences and a paper. Prerequisite: Reading knowledge of an East Asian language and consent of instructor. 3 hours or 1 unit. May be repeated for a maximum of 6 hours or 2 units.
450. **Seminar in Asian Studies.** Seminar on selected Asian and Middle Eastern topics. The topic will vary with the instructor and the seminar may be repeated for a maximum of 3 units. Prerequisite: Consent of instructor. 1 unit.
490. **Individual Study and Research in Special Topics.** Supervised individual investigation or study of a topic not covered by regular course offerings. The topic selected by the student and the proposed plan of study must be approved by the Asian studies curriculum adviser and the staff member who supervises the work. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 3 units.

Chinese

201. **Elementary Chinese, I.** An introduction to Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Chinese, II.** Second term of spoken Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Chinese. Prerequisite: Chinese 201. 5 hours.
203. **Intermediate Chinese, I.** First term of second year of the Chinese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. Prerequisite: Chinese 202 or 301, or equivalent. 5 hours.
204. **Intermediate Chinese, II.** Concentration on ability to engage in fluent discourse, on comprehensive grammatical knowledge, and on ability to read ordinary simple text in Chinese. Prerequisite: Chinese 203 or equivalent. 5 hours.
207. **Chinese Literature in Translation, I.** An introductory survey of Chinese literature and its cultural and historical background from earliest times to the end of the T'ang. No knowledge of Chinese is required. 3 hours.
208. **Chinese Literature in Translation, II.** An introductory survey of Chinese literature and its cultural and historical background from the end of the T'ang to the present. No knowledge of Chinese is required. Prerequisite: Chinese 207 or consent of instructor. 3 hours.
209. **Chinese Thought, I.** A survey of early Chinese thought before the introduction of Buddhism with emphasis on Confucianism and Taoism. No knowledge of Chinese required. 3 hours.
210. **Chinese Thought, II.** Survey of Chinese thought since the introduction of Buddhism with emphasis on Buddhism, Neo-Confucianism, and the impact of the West. No knowledge of Chinese required. 3 hours.
211. **Chinese Calligraphy.** Brief history of Chinese calligraphy; practice of regular and grass forms with Chinese brush pens. Prerequisite: Chinese 202 or equivalent. 1 hour.
301. **Intensive Chinese, I.** Intensive introduction to the spoken and written Chinese language; emphasizes the introduction of basic vocabulary and sentence patterns. This course is equivalent to Chinese 201 and 202. For all students who have no previous Chinese and who want to learn at a rapid rate. 10 hours or 2 units.
302. **Intensive Chinese, II.** Continuation of Chinese 301. Emphasizes conversation and reading. This course is equivalent to Chinese 203 and 204. Prerequisite: Chinese 202 or 301, or equivalent. 10 hours or 2 units.
303. **Oral Chinese, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Chinese 204 or 302, or equivalent. 3 hours or 1 unit.

304. **Oral Chinese, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Chinese 303 or consent of instructor. 3 hours or 1 unit.
305. **Advanced Readings in Modern Chinese, I.** Reading and translation of graded selections from modern Chinese literary and journalistic writing. Prerequisite: Two years of modern Chinese. 3 hours or 1 unit.
306. **Readings in Modern Chinese, II.** Reading in modern Chinese literary and journalistic writings; introduction to classical Chinese to prepare students of modern Chinese to understand classical forms and quotations in vernacular text and to use dictionaries and reference works. Prerequisite: Chinese 305 or equivalent. 3 hours or 1 unit.
307. **Introduction to Literary Chinese.** An introduction to literary language, style, and structural patterns as reflected in the Confucian classics and other literary, philosophical, and historical texts. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
308. **Readings in Literary Chinese.** Readings in texts selected from the Confucian classics and other literary, philosophical, and historical texts. Attention is given to linguistic and intellectual patterns and to problems of translation. Prerequisite: Chinese 307 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
309. **Social Science Readings in Chinese.** Reading and translation of selected Chinese texts in the social sciences with emphasis on specialized terminology and prose style. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
310. **Modern Chinese Literature.** Reading and analysis of selected works of Chinese literature since the May 4 Movement with special attention to the relationship between literature and ideology in twentieth-century China. Prerequisite: Chinese 304 or equivalent. 3 hours or 1 unit.
311. **The Chinese Novel.** Reading and analysis of representative pieces of Chinese fiction from the fourth century B.C. to 1900 with emphasis on the development of Chinese fiction, its place in the literary tradition, and its role in society. No knowledge of Chinese is required. 3 hours or 1 unit.
312. **Modern Chinese Literature in Translation.** Readings and analysis of representative selections from Chinese literature since the May 4 Movement, with special attention to the relationship between literature and ideology in twentieth-century China. No knowledge of Chinese is required. 3 hours or 1 unit.
315. **Introduction to Colloquial Chinese Literature.** Reading and close analysis of colloquial texts selected from Chinese literature. Prerequisite: Chinese 306 or equivalent. 3 hours or 1 unit.
317. **Introduction to Classical Chinese Literature.** Reading and analysis of classical texts selected from Chinese literature; emphasis on poetry and artistic prose. Prerequisite: Chinese 315 or 307. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Japanese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
350. **Research Methods and Bibliography in Chinese Studies.** Introduction to the problems of translation and to the variety, nature, structure, and usage of Chinese reference works. Exercises are assigned involving application of research methods peculiar to Chinese studies and the use of the appropriate reference aids. Prerequisite: Chinese 307 or consent of instructor. 3 hours or 1 unit.

Japanese

150. **Introduction to Japanese Culture.** A topical introduction to Japanese cultural and aesthetic life with attention to cultural and aesthetic patterns as they are reflected in literature, language, and the arts. 3 hours.

201. **Elementary Japanese, I.** An introduction to Japanese, including conversation with a native Japanese-speaking tutor under the direction of the linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Japanese, II.** Second term of spoken Japanese, including conversation with a native Japanese-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Japanese. Prerequisite: Japanese 201. 5 hours.
203. **Intermediate Japanese, I.** First term of second year of the Japanese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. Prerequisite: Japanese 202 or 301, or equivalent. 5 hours.
204. **Intermediate Japanese, II.** Concentration on ability to engage in reasonably fluent discourse in Japanese, on comprehensive views of formal grammar, and on ability to read simple ordinary written Japanese. Prerequisite: Japanese 203 or equivalent. 5 hours.
205. **Japanese Literature in Translation, I.** A survey of Japanese literature from earliest times to around 1600 A.D.; readings in prose, poetry, and drama in English translation. 3 hours.
206. **Japanese Literature in Translation, II.** A survey of Japanese literature from around 1600 A.D. to recent times; readings in prose, poetry, and drama in English translation; and lectures and papers. 3 hours.
301. **Intensive Japanese, I.** An intensive introduction to spoken and written Japanese; emphasis on basic grammatical patterns and vocabulary. Equivalent to Japanese 201 and 202; for students who have no previous Japanese and who want to learn at a rapid rate. 10 hours or 2 units.
302. **Intensive Japanese, II.** Continuation of Japanese 301. Emphasis on conversation and reading. Equivalent to Japanese 203 and 204. Prerequisite: Japanese 202 or 301, or equivalent. 10 hours or 2 units.
303. **Oral Japanese, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Japanese 204 or 302, or consent of instructor. 3 hours or 1 unit.
304. **Oral Japanese, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Japanese 303 or consent of instructor. 3 hours or 1 unit.
305. **Readings in Modern Japanese, I.** Reading and translation of selected texts in modern Japanese. Prerequisite: Two years of Japanese. 3 hours or 1 unit.
306. **Readings in Modern Japanese, II.** Continuation of Japanese 305. Reading and translation of selected texts in modern Japanese. Prerequisite: Japanese 305 or equivalent. 3 hours or 1 unit.
309. **Social Science Readings in Japanese.** Readings in Japanese social science materials, including articles from newspapers, periodicals, and learned journals. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit. May be repeated for a maximum of 9 hours or 3 units.
310. **Modern Japanese Literature.** Readings and analysis of selected Japanese texts, primarily fiction. Prerequisite: Japanese 304 or equivalent. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Korean

330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages

es; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Sanskrit

201. **Elementary Sanskrit, I.** Introduction to Sanskrit, treating in full the grammar of the language as preparation for reading, and including the reading of sections of the *Mahabharata*. 5 hours.
202. **Elementary Sanskrit, II.** Continuation of Sanskrit 201. Prerequisite: Sanskrit 201. 5 hours.
309. **Introduction to Sanskrit Literature in English Translation.** Focus on different forms of Sanskrit literature in English translation with emphasis on drama, poetry, and poetics. 3 hours or 1 unit.

ASTRONOMY

Head of Department: Professor I. Iben, Jr.

Department Office: 103 Observatory, Urbana

100. **Perspectives in Astronomy.** A one-semester introduction to astronomy. The nature of science; sun, planets, and moons; origin of the solar system; nature and evolution of stars; exploding stars; stellar remnants, including dwarfs, neutron stars, and black holes; molecules in space; galaxies and quasars; past and future of the universe; and life in the universe. Lectures and observation. Credit is not given to students with credit in Astronomy 101, 102, or 300; not open to students with credit in Physics 102, 107, or equivalent. 3 hours.
101. **Descriptive Astronomy.** The first semester of a two-semester introduction to astronomy. Introductory survey of the universe; structure and motions of the earth and moon; planetary motions; physical nature of the planets; comets and meteors; and origin and evolution of the solar system. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 100, 210, or 300; not open to students who have credit in Physics 102, 107, or equivalent. 4 hours.
102. **Descriptive Astronomy.** The stars: distances, motions, and dimensions; atoms and radiation; structure, origin, and evolution of stars; structure of the Milky Way; and galaxies and the structure of the universe. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 100, 210, or 300. Prerequisite: Astronomy 101. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
210. **General Astronomy.** A survey of astronomy for students having some background in physics. The approach is primarily descriptive, but mathematical techniques are used where needed. The chief topics are orbits and gravitation; the bodies of the solar system; the nature and evolution of the stars; galaxies; and the structure of the universe. Credit is not given to students who have credit in Astronomy 101, 102, or 300. Prerequisite: Physics 102, 107, or equivalent. 3 hours.
290. **Individual Study.** Individual study at an advanced undergraduate level. Prerequisite: Consent of adviser and of staff member who supervises the work. 2 to 4 hours.
300. **Astronomy for Teachers.** A general course in astronomy designed for teachers which includes classical astronomy, modern developments, and aspects of the space program; discussion of available curriculum materials for elementary and secondary teaching and some practice given in telescopic observation. Credit is not given to students with credit in Astronomy 101, 102, or 210, or to astronomy majors. Graduate credit is given

only to students in elementary and secondary teacher training programs. 4 hours or 1 unit.

301. **Introductory Astrophysics.** Stars: observational data and their determination; atoms and radiation; stellar atmospheres; equilibrium of stellar interiors; special types of stars; and interstellar matter. Prerequisite: Physics 108. 3 hours or 1 unit.
304. **Astrophysics, I.** Introduction to astrophysical problems, with emphasis on underlying physical principles; includes the nature of stars, equations of state, stellar energy generation, stellar structure and evolution, astrophysical neutrinos, binary stars, white dwarfs, neutron stars and pulsars, and novae and supernovae. Prerequisite: Physics 108. 3 hours or 1 unit.
305. **Astrophysics, II.** Introduction to astrophysical problems; includes fundamentals of solar system astrophysics, elements of physical cosmology, and such additional topics as galactic nuclei, quasars, cosmic ray nuclei, the interstellar medium, and cosmic electrodynamics. Prerequisite: Astronomy 304. 3 hours or 1 unit.
314. **Observational Astronomy.** Introduction to astronomical equipment; optical photography and radio mapping; astronomical coordinate systems and transformations; determination of latitude, longitude, and time; and introduction to error theory and applications. Practical experience with the 12-inch refractor and 120-foot radio telescope. Lectures and laboratory. Prerequisite: Astronomy 102 or 210; Mathematics 140, 141, or 145. 4 hours or 1 unit.
315. **Observational Techniques and Reductions.** Methods of observation and reduction in optical and radio wavelength regions, photographic and photoelectric photometry, spectrophotometry, optical and radio line profiles; radial velocity determinations; stellar diameters from lunar occultations; and pulsar timing. Practical experience with the 40-inch reflector and 120-foot radio telescope. Lectures and laboratory. Prerequisite: Astronomy 314. 4 hours or 1 unit.
321. **Stellar Systems, I.** Galactic structure: the observational data; stars in the solar neighborhood; the solar motion; stellar statistics and distribution; stellar populations; interstellar matter and spiral structure; and the whole galaxy. Prerequisite: Astronomy 102 or 210; Physics 108. 3 hours or 1 unit.
322. **Stellar Systems, II.** Continuation of Astronomy 321. Galactic dynamics: stellar motions; galactic rotation; dynamics and mass distribution; stellar encounters; and dynamics of interstellar matter. Galaxies: distances; structural features; groups and clusters; radio galaxies and quasars; and spatial distribution and motions. Prerequisite: Astronomy 321. 3 hours or 1 unit.
396. **Seminar in Astronomy.** Lectures on topics of current interest in astronomy and astrophysics; for advanced undergraduates and graduates. See *Timetable* for current topics. Prerequisite: Consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
401. **Stellar Atmospheres.** Physical characteristics of stellar atmospheres as derived from spectroscopic observations; radiation transfer; theory and observations of the continuous spectrum; limb darkening; formation of absorption lines; line profiles; curves of growth; relative chemical abundances; and emission features. Prerequisite: Consent of instructor. Desirable background includes some familiarity with atomic physics, advanced calculus, and general astronomy. 1 unit.
402. **Theoretical Astrophysics.** Same as Physics 402. Application of physical principles to selected topics in astrophysics, including stellar structure and evolution, neutron stars and pulsars, cosmic electrodynamics, and cosmological problems; emphasis on the physics involved rather than on detailed factual description. Prerequisite: Physics 342 or 386, or consent of instructor. 1 unit.
403. **Gaseous Nebulae and the Interstellar Medium.** Distribution, structure, and spectra of nebulae; physical processes in planetary and diffuse nebulae; recombination, fluorescence, and forbidden line radiation; determination of physical parameters; nature of the interstellar medium; interstellar gas and grains; and observation of interstellar medium. Prerequisite: Astronomy 301. 1 unit.

- 404. Stellar Structure and Evolution.** Same as Physics 404. Relationship between observable features of stars and the physical processes that occur in their interiors; topics include matter and radiation in stars (equations of state, modes of energy flow, nuclear energy production, and element synthesis); structure of stars during all phases prior to the supernova or planetary nebula stage; stellar pulsations with reference to Cepheids and RR Lyrae variables; and properties of white dwarfs, neutron stars, and contact binaries. Prerequisite: Physics 360 and 382, or Astronomy 402 or Physics 402; or consent of instructor. 1 unit.
- 405. Theory of the Interstellar Medium.** Same as Physics 405. Interstellar gas; balance of microscopic processes, large scale structure, interaction with stars, dynamics, heating, ionization, and cooling; continuous and discrete radiation processes, excitation mechanisms, propagation of radiation, molecule formation, dust grains, star formation, magnetic fields, and cosmic rays. Prerequisite: Consent of instructor. 1 unit.
- 424. General Relativity and Cosmology.** Same as Mathematics 460 and Physics 424. Foundations of general relativity and applications to problems of astrophysics; includes gravitation as geometry, mathematical tools, Einstein's equations, relativistic stellar structure, black holes and gravitational collapse, cosmology, gravitational radiation, and experimental tests. Prerequisite: Physics 322, 411, 412, and 442, or equivalent; or consent of instructor. 1 unit.
- 433. Solar System Astrophysics.** Planetary orbits and perturbations; physical perturbations; physical parameters of the planets; planetary interiors, atmospheres, magnetospheres, and surface layers; the satellites; asteroids and comets; meteors, meteorites, and tektites; interplanetary grains and gas; and problems of origin and evolution. Prerequisite: Consent of instructor. 1 unit.
- 490. Individual Study.** Individual study or nonthesis research. Prerequisite: Consent of adviser and of staff member who supervises the work. $\frac{1}{2}$ to 2 units. May be repeated to a maximum of 4 units.
- 496. Seminar in Special Topics.** Prerequisite: Consent of instructor. 0 to 4 units.
- 499. Thesis Research.** 0 to 4 units.

ATMOSPHERIC SCIENCES

Director of Laboratory: Professor Y. Ogura

Laboratory Office: 6-113 Coordinated Science Laboratory, Urbana

- 222. Weather Processes.** Introduction to the mean state of the atmosphere, the fundamental physics of weather processes, and the mechanisms producing daily weather changes, both qualitative and quantitative in nature. Prerequisite: Mathematics 141. 3 hours.
- 301. Principles of Atmospheric Physics.** Introduction to the basic physics and mathematics necessary to do research in meteorology. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
- 302. Principles of Atmospheric Dynamics.** An introduction to those elements of fluid dynamics and thermodynamics essential to understanding the large- and small-scale motions of neutral atmosphere. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
- 401. Weather Analysis.** Describes the workings of the real atmosphere by giving the student practical experience in weather analysis, with emphasis on physical interpretation; also reviews the methods and procedures of weather analysis by numerical processes, in particular methods of deducing vertical motions. Prerequisite: Atmospheric Sciences 301 and 302. 1 unit.
- 405. Simulation of Atmospheric Dynamics: Numerical Techniques.** Intended to give the student practical numerical techniques for solving those linear and nonlinear differen-

- tial equations which appear frequently as initial and boundary value problems in hydrodynamics and dynamic meteorology. Prerequisite: Mathematics 343 or consent of instructor. 1 unit.
406. **Simulation of Atmospheric Dynamics: Physical Aspects.** Intended to describe the principles and methods of simulating and predicting large-scale atmospheric motions on the basis of hydrodynamics and thermodynamics. Prerequisite: Atmospheric Sciences 302. 1 unit.
408. **Atmospheric General Circulation.** Reviews the observed general circulation of the earth's atmosphere; discusses the balance requirements of mass, momentum, and energy conservation; illustrates, by means of different mathematical modelings and laboratory physical modeling, the important processes which determine the earth's and other planets' general circulation; and considers theories of climatic changes. Prerequisite: Atmospheric Sciences 301 or equivalent, and Atmospheric Sciences 302. 1 unit.
490. **Individual Study.** Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
491. **Seminar in Atmospheric Sciences.** Seminar on topics of current interest; see *Timetable* for current topics. Prerequisite: Consent of instructor. 0 to 1 unit.
497. **Special Topics in Atmospheric Sciences.** Lecture course in topics of current interest; subjects such as oceanic circulation, physical meteorology, upper atmosphere dynamics, atmospheric convection, atmospheric turbulence and boundary layers, dynamic oceanography, and advanced topics in atmospheric dynamics will be covered in semester offerings on a regular basis. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Section A, for master's degree candidates; Section B, for doctoral degree candidates. Prerequisite: Consent of instructor. 0 to 4 units.

AVIATION

Director of Institute: R. E. Flexman

Institute Office: Terminal Building, University of Illinois-Willard Airport, Savoy 61874

100. **Introduction to Aviation.** The role of aviation in the modern world, including private flying, general aviation, commercial aviation, and air transport operations, history of aviation, introductory aerodynamics, types of aircraft, aircraft structures and systems, survey of pilot requirements, airline and business flight operations, fixed-base operations, aviation research, present and future challenges to aviation, and opportunities in aviation. 3 hours.
101. **Private Pilot.** Prepares the beginning flight student for an FAA Private Pilot certificate; emphasis on airplane utility and safety. Forty-eight classroom hours of ground school instruction on federal aviation regulations, air navigation, radio communications, weather, general operation of airplanes, and safety practices; thirteen hours of flight discussion; eleven hours of flight simulator training; and thirty-two hours of flight training, plus one hour flight check, in various makes of airplanes. 3 hours.
102. **Orientation Refresher.** An intermediate course to provide additional aeronautical proficiency in the primary trainer and serve as an introduction to other types of aircraft; emphasis on airplane utility and safety; eighteen hours of flight, four hours of flight simulator training, and five hours of flight discussion directed to airplane operation. Prerequisite: Credit or concurrent registration in Aviation 101, or consent of director. 0 credit.
105. **Soaring, I.** Basic soaring for those with no previous flight experience; an aviation recreational course covering regulations, navigation, meteorology, aerodynamics, launching, and flight maneuvers required for glider operation; includes approximately twenty dual flights, five solo flights, and eight hours of ground discussion. 1 hour.

115. **Soaring, II.** Intermediate soaring for those with any power flight certificate or previous soaring experience equivalent to Aviation 105; offers additional experience and knowledge preparatory to glider pilot certification; includes approximately ten dual flights, fifteen solo flights, and eight hours of ground discussion. Prerequisite: Aviation 105 or equivalent. 1 hour.
120. **Secondary Flight.** The second phase of flight training in preparation for an FAA Commercial Pilot certificate; develops further the qualities of a good pilot, broadens experience, and introduces advanced maneuvers; forty-eight classroom hours of ground school instruction in meteorology and aircraft engines, and forty-four hours of flight training (sixteen dual and twenty-eight solo) in four-place airplanes. Prerequisite: Aviation 101 or private pilot certificate; consent of director. 3 hours.
130. **Intermediate Flight.** The third phase of flight training in preparation for an FAA Commercial Pilot certificate; emphasis on cross-country, night, and instrument flying; includes forty-eight classroom hours of ground school instruction in cross-country planning and in-flight procedures, including navigation and radio communications, and forty-three hours of training (seventeen dual, twenty-one solo, and five flight simulator) in two-place side-by-side radio-equipped aircraft. This course may be taken by private pilots who wish to increase their cross-country and night-flying proficiency. Prerequisite: Aviation 101 or private pilot certificate; check out in aircraft; consent of director. 3 hours.
140. **Advanced Flight.** The final phase of flight training in preparation for an FAA Commercial Pilot certificate; emphasis on precision flying. Forty-eight classroom hours of ground school instruction including general operation of airplanes and a review of federal aviation regulations, navigation, radio communications, meteorology, and aircraft engines in preparation for a commercial pilot certificate, and forty-four hours of flight training (fourteen dual and thirty solo) in two-place tandem monoplanes or four-place monoplanes, plus one hour of flight check time. Prerequisite: Aviation 120 and 130; consent of director. 3 hours.
141. **Aircraft Powerplants.** Designed to give an insight into the construction and operation of the wide variety of reciprocating and jet engines used in various aircraft; emphasizes advantages and disadvantages of each type of powerplant; and includes basic troubleshooting. 3 hours. Students may not receive credit for both Aviation 141 and 142.
142. **Powerplant Theory.** A study of reciprocating and turbine internal combustion aircraft engines; includes history and development of powered flight, advances in thermodynamics and metallurgy, and improvements in volumetric and mechanical efficiencies; and also a study of supporting systems and design variations for all types of aircraft engines in use. 4 hours. Students may not receive credit for both Aviation 142 and 141.
143. **Aircraft Materials and Processes, I.** Theory and practice in the techniques of precision measurement, safetying, and nondestructive inspection; identification and use of materials suitable for aircraft construction. 2 hours. Students may not receive credit for both Aviation 143 and 175.
144. **Powerplant Theory Laboratory.** An application of the principles of construction, theory of operation, and airworthiness criteria as introduced in Aviation 142; includes maintenance procedures and engine operation for both piston and turbine powerplants. Prerequisite: Credit or concurrent registration in Aviation 142. 2 hours.
145. **Aircraft Physics.** A study of the basic physical principles that apply to present-day aerospace vehicles; includes AC and DC theory, power sources, transmission, measurement, solid state devices, and troubleshooting problems existing in aircraft electrical circuits. 3 hours.
147. **Introduction to Federal Aviation Regulations.** A study of regulations, directives, and specifications governing the manufacture, operation, and maintenance of aircraft, and the control of air traffic as well as the qualifications and certification of personnel and equipment engaged in aircraft operation and maintenance. 3 hours.
152. **Powerplant Systems, I.** Theory and operating principles of the ignition, starting, and

electrical power generating components and systems used with aircraft turbine and reciprocating powerplants. Prerequisite: Aviation 142 and 145. 4 hours.

153. **Aircraft Materials and Processes, II.** A survey of materials used in the manufacture of structural components of aerospace vehicles; emphasis on the sources, manufacturing processes, physical properties, and working characteristics of various ferrous and non-ferrous metals. 2 hours. Students may not receive credit for both Aviation 153 and 175.
154. **Powerplant Systems, II.** Theory of operation, design, and maintenance procedures for fixed pitch and controllable propellers; includes a study of propeller governing and control systems for reciprocating and turboprop engines. Prerequisite: Aviation 145. 3 hours.
155. **Aircraft Mathematics.** Arithmetic fundamentals and their application to the field of aviation mechanics; includes wing rib layout, bend allowance, load factors, weight and balance, engine thrust and horsepower, and fuel and oil consumption problems. 3 hours.
156. **Powerplant Systems, III.** An introduction to fuels and fuel systems as related to aircraft turbine and reciprocating powerplants; study of fuel system functions including carburetion, fuel injection, fuel management, and supercharging. Prerequisite: Aviation 142 and 145. 3 hours.
157. **Powerplant Conditioning and Testing.** A study of powerplant malfunction, diagnosis and maintenance procedures, materials, and equipment; includes condition monitoring techniques and some of the economic aspects of powerplant maintenance. Prerequisite: Aviation 152 and 156. 7 hours.
159. **Powerplant Inspection and Regulations.** A study of federal aviation regulations, advisory circulars, airworthiness directives, and manufacturers' publications as they apply to aircraft powerplants; includes a survey of specialized inspection techniques and equipment for both destructive and nondestructive inspection procedures. 3 hours.
163. **Aircraft Materials and Processes, III.** A survey of nonstructural materials used in the construction of aircraft components; the sources, manufacturing processes, physical properties, and working characteristics of synthetics, fabrics, composites, woods, and their associated surface treatments studied in detail. 3 hours. Students may not receive credit for both Aviation 163 and 175.
164. **Basic Aircraft Systems.** Survey of modern aircraft systems, including environmental and life-support systems, ice and rain control, fire detection and extinguishing systems, hydraulic, pneumatic, flight, and ground control systems, and aircraft electrical power and lighting systems. 3 hours. Students may not receive credit for Aviation 164 and Aviation 169, 170, or 172.
165. **Aircraft Fabricating Processes, I.** Procedures and techniques of mechanical, nonfusion attachment; sheet metal forming; and use of adhesives, bonded materials, and plastics in aircraft component fabrication. Laboratory experiences include the use of mechanical fasteners, similar and dissimilar metal assembly, and plastic and bonded structure fabrication. Prerequisite: Aviation 143, 153, and 155. 4 hours. Students may not receive credit for both Aviation 165 and 175.
167. **Aircraft Fabricating Processes, II.** Fusion and adhesion procedures and techniques including gas, AC and DC arc, and inert gas processes. Laboratory experiences include fusion and adhesion processes with representative metals used in the aircraft industry. Prerequisite: Aviation 143 and 153; General Engineering 105. 2 hours. Students may not receive credit for both Aviation 167 and 175.
169. **Aircraft Systems, I.** A study of basic principles and design concepts of the environmental and life-support systems used in modern aircraft; study of representative systems for pressurization, oxygen, heating, cooling, and ice and fire protection with detailed emphasis on individual components and their relationship to the complete system. Prerequisite: Aviation 145. 4 hours. Students may not receive credit for both Aviation 169 and 164.
170. **Aircraft Systems, II.** Electrical distribution circuits and associated lighting, power, communication, navigation, and instrumentation systems common to modern aircraft;

- emphasis on circuit analysis and performance testing. Prerequisite: Aviation 145, 152, and 155. 5 hours. Students may not receive credit for both Aviation 170 and 164.
172. **Aircraft Systems, III.** Includes hydraulic and pneumatic power systems as utilized in modern aircraft; emphasis on theory of operation, design concepts, component relationships, and malfunction diagnosis. Prerequisite: Aviation 145. 3 hours. Students may not receive credit for both Aviation 172 and 164.
174. **Aircraft Assembly and Inspection.** Aircraft assembly, configuration, and alignment consistent with associated aerodynamics theory; study of structure and systems inspection and FAA regulations related to the achievement of maximum safety of aircraft. Prerequisite: Aviation 163, 165, 167, 170, and 172. 5 hours. Students may not receive credit for both Aviation 174 and 175.
175. **Basic Airframes.** Survey of modern aircraft design characteristics and construction procedures, including basic aerodynamics of fixed and rotary wing aircraft, materials and techniques of fabrication, assembly and rigging procedures of aircraft components, and characteristics and effects of structural deformation and misalignment. 3 hours. Students may not receive credit for Aviation 175 and Aviation 143, 153, 163, 165, 167, or 174.
182. **Basic Electronic Theory.** Characteristics of alternating current; time-varying circuits; analyzing behavior of alternating current components; phase and power factor; power measurement; integrating circuits; differentiating circuits and other miscellaneous alternating circuits; and principles of vacuum tubes and transistors. 3 hours.
183. **Advanced Electronic Theory.** Timed circuits and circuits for power supplies, detectors, amplifiers, and oscillators; ultrahigh frequencies and microwaves; principles of radar and microwave systems; time-constant and pulse-forming circuits; and locking, switching, and sweep circuits. Prerequisite: Aviation 182. 3 hours.
200. **Basic Instrument Flight Techniques.** First course in preparing the commercial pilot for an FAA instrument rating. Forty-eight classroom hours of ground school instruction in theory of instrument flight, airplane instruments and instrument systems, navigation, meteorology, and federal aviation regulations; eighteen hours of simulated instrument flight; and ten to fifteen hours of instrument flight simulator training. Prerequisite: Commercial pilot certificate or equivalent flight experience; junior standing; consent of director. 3 hours.
210. **Advanced Instrument Flight Procedures.** Second and final course leading to an FAA instrument rating. Forty-eight classroom hours of ground school instruction in preflight planning and in-flight procedures including use of instrument flight publications, navigation, meteorology, and air traffic control procedures; seventeen hours of simulated instrument flight plus one hour flight check; and ten to fifteen hours of instrument flight simulator training. Prerequisite: Aviation 200 or forty hours of simulated instrument flight experience; junior standing; consent of director. 3 hours.
220. **Flight Instructor.** Prepares the commercial pilot for an FAA Flight Instructor certificate. Forty-eight classroom hours of ground school instruction on techniques of flight instruction and theory of flight, and a minimum of twenty-eight hours of flight training in four-place aircraft, two hours in a flight simulator, three hours practice teaching in a flight simulator, and one hour flight check. Prerequisite: Commercial pilot certificate; instrument rating; junior standing; consent of director. 3 hours.
222. **Instrument Flight Instructor Course.** Leads to an instrument instructor's rating on the student's flight instructor certificate; five hours of simulator, ten hours of flight, and one hour of flight check time. Includes refresher on chart symbol interpretation, federal aviation regulations, communications, instrument construction and operation, and electronic aids to navigation; designed to include obtaining a flight instructor instrument rating. Prerequisite: Commercial pilot certificate; instrument rating; flight instructor certificate; airplane rating; consent of director. 1 hour.
224. **All Attitude Orientation.** Safe handling of an aircraft in all attitudes through various aerobatic maneuvers which include loops, snap rolls, slow rolls, Immelmann, Cuban

8's, and similar type maneuvers; thorough check of takeoff and landing procedures. Prerequisite: Aviation 101 or the private pilot certificate. 1 hour.

250. **Practice Teaching, Airplane.** Practice teaching using classroom, audiovisual material, simulator, and airplane; prepares the certified flight instructor to teach in all modes of aviation education. A minimum of two hours of classroom lecture, twenty hours of simulator instruction, and six hours of airplane instruction is given by the student; an additional twenty hours of classroom lecture clarifies and explains the proper method of successful instruction. Prerequisite: Aviation 220 or flight instructor certificate; junior standing; consent of director. 3 hours.
260. **Aerospace History.** Surveys civilian and military developments since 1900, emphasizing U.S. civil aviation and astronautics; includes technological trends with stress on political, economic, and social implications, both domestic and international. 3 hours.
280. **Special Rating (Multiengine Land).** Prepares the commercial pilot for an FAA multiengine land airplane rating; sixteen hours of ground school instruction and nine hours of flight training in a multiengine land airplane. Prerequisite: Commercial pilot certificate; consent of director. 1 hour.
291. **Special Ratings and/or Specialized Flight.** Prepares the commercial pilot for special FAA pilot certificates and/or ratings such as seaplane, airline transport pilot, and helicopter, and specialized flight such as advanced multiengine operation; sixteen hours of preflight (ground school) instruction and variable flight instruction as selected by the student. Options are advanced multiengine, helicopter, and airline transport pilot. Registration is limited to professional students with approval of director through chief flight instructor. Prerequisite: Commercial pilot certificate; consent of director. 1 hour.
294. **Airport Management.** Management problems in planning, design, operation, maintenance, and administration of airports; legislation and federal regulations affecting air commerce and airports; and current problems in certification, security, safety, land acquisition, zoning, and state and federal participation in airport development. Prerequisite: Aviation 101 and Business Administration 210 or 247, or consent of instructor. 3 hours.
295. **Aviation Logistics.** Factors involved in aviation operation, including those associated with maintenance management, personnel management, cost control, sales, public relations, accounting procedures, labor relations, fuel, food, and airport contracts, and training programs. Prerequisite: Junior standing and consent of instructor. 3 hours.
355. **Aviation Safety Augmentation.** Fundamental concepts of aviation safety augmentation with emphasis on accident prevention through accident investigation, casualty reduction through crashworthy design, and safety enhancement resulting from litigation; accident investigation techniques and crash survival design factors. Prerequisite: Aviation 101, 141, and 175; or consent of instructor. 3 hours, or ½ or 1 unit.
397. **Human Factors in Aviation Research.** Research topics dealing with pilot training and aircraft displays, such as pilot selection and performance prediction, adaptive training, use of aircraft simulators, evaluation of momentary and sustained pilot workload, symbolic versus pictorial displays, and computer-generated displays; emphasizes new methods, procedures, and current approaches to behavioral research in aircraft systems. Prerequisite: Psychology 235 and 258, or equivalent. 3 hours, or ½ or 1 unit.

BANDS

Director: Professor H. Begian

Office: 140 Band Building, Champaign

All band courses are open to men and women students who have been accepted by examination, with assignments being made according to proficiency and instrumentation. Completion

of each course involves in addition to the regular schedule of rehearsals, participation in the public appearances of the bands.

101. **Symphonic Band--Large.** Maintains a complete symphonic band instrumentation for the study and performance of all types of band literature. 1 hour.
102. **Symphonic Band--Small.** Maintains a complete small symphonic band instrumentation for the study and performance of band literature intended for the smaller instrumentation. 1 hour.
103. **First Concert Band.** Maintains the instrumentation of the standard band and serves as a training organization for the symphonic bands. The literature studied and performed is of the highest calibre and technical difficulty. 1 hour.
104. **Second Concert Band--A.** Enrolls those who do not at first qualify for positions in the other bands until they become eligible for promotion as improvement is shown and as vacancies occur. The band literature studied is of high quality but technically is less difficult than the music for the top three bands. 1 hour.
105. **Second Concert Band--B.** Enrolls those who do not at first qualify for positions in the other bands until they become eligible for promotion as improvement is shown and as vacancies occur. The band literature studied is of high quality but technically is less difficult than the music for the top three bands. 1 hour.
106. **Marching Band.** The Marching Band prepares and performs at least six shows per football season; music used is of the best quality available for this type of service activity. 1 hour.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.

BIOCHEMISTRY

(See Chemical Sciences)

BIOENGINEERING

(See Mechanical and Industrial Engineering)

BIOLOGY

(See Life Sciences)

BIOPHYSICS

(See Life Sciences)

BOTANY

(See Life Sciences)

BUSINESS

Dean of College: Dean V. K. Zimmerman

College Office: 260 Commerce Building (West), Urbana

299. **International Business Study in Absentia.** Upon prior written approval of the adviser, the major department, and the College of Commerce and Business Administration office, a student may earn up to 18 credit hours per semester undertaking a study and/or research project in international business away from the Urbana-Champaign campus. The student's major department verifies the satisfactory progress of the work by means of interim and final written reports, written or oral examinations, or other means established by the department. While absent from the Urbana-Champaign campus, the student must continue to pay all fees required by the University of Illinois to retain continuity of enrollment and to allow the time spent away from this campus to count toward residency. Prerequisite: The student must be a commerce major in good standing who has completed at least 45 semester hours toward a bachelor's degree with at least one semester in residence at the University of Illinois. 0 to 18 hours. This course may be repeated for a maximum of 36 credit hours, all of which must be earned within twelve consecutive months.

BUSINESS ADMINISTRATION

Head of Department: Professor K. P. Uhl

Department Office: 350 Commerce Building (West), Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **The Legal Environment of Business.** Examination of the nature of law and the formation and application of legal principles; the role of law in society; the legal environment in which business operates, particularly government taxation; the regulation of commerce, competition, and labor-management relations; and the concept of property: its creation, transfer, and importance to our business society. Prerequisite: Junior standing. 3 hours.
202. **Principles of Marketing.** Emphasis on the marketing concepts of planning, organization, control, and decision making from the viewpoint of the business executive. Credit is not given for both Business Administration 202 and 272. Prerequisite: Economics 172 or equivalent. 3 hours.
203. **Principles of Business Law.** Contracts, the uniform commercial code, creditors' rights, agency and employment, business organizations, and property. Prerequisite: Business Administration 200. 4 hours. Credit is not given for both Business Administration 203 and 261.
206. **Marketing Environment.** Attention is given to the relationship of firm to firm, to government, to labor, and to other organized groups or institutions as they interact with the marketing function of the firm; emphasis on the importance of marketing operations on cultural, political, and social forces, and how these forces affect the alternatives

considered and the decision methods used by marketing management. Prerequisite: Business Administration 202. 3 hours.

210. **Management and Organizational Behavior.** A general analysis of management and organizational behavior from a systems point of view, including classical organizational theory and management, organizational behavior, and management science; environmental forces; planning, organizing, and control processes; motivation, incentives, leadership, communication, and interpersonal relations; and discussion of production and decision-making and mathematical models. Credit is not given for both Business Administration 210 and 247. Prerequisite: Junior standing. Students are encouraged to take Business Administration 210, 202, and Finance 254 concurrently. 3 hours.
212. **Retail Management.** Fundamentals of buying, sales promotion, pricing, control, and store finance. Prerequisite: Business Administration 202. 3 hours.
247. **Introduction to Management.** Summary of management in a modern industrial enterprise; emphasis on motivation, small group behavior, and the problems of designing and operating a formal organization structure. For noncommerce students only. Credit is not given for both Business Administration 247 and 210. Prerequisite: Sophomore standing. 3 hours.
249. **Human Relations.** Interrelationships of individuals and groups within the work environment of an industrial organization; motivation and communication for work and cooperation between managers and different economic and social groups; and qualifications and practices of the successful manager. Open to noncommerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.
261. **Summary of Business Law.** Basic principles of the private law of business including the law of contracts, agency, and business organizations; a brief introduction to the law of sales, commercial paper, security devices, and property. Prerequisite: Junior standing. 3 hours. Credit is not given for both Business Administration 261 and 203.
272. **Industrial Selling.** A survey course in marketing and salesmanship for noncommerce students interested in selling industrial products. Credit is not given for both Business Administration 272 and 202. 3 hours.
290. **Human Values and Business Behavior.** Designed to compel tomorrow's business leaders to develop reasoned viewpoints on critical issues and to sharpen their analytical skills in evaluating a variety of viewpoints on a diversity of topics; aims to contribute to more effective business leadership and community citizenship. Open to advanced undergraduate honors students in the University. Prerequisite: Advanced standing; James Scholar or participant in a departmental honors program. 3 hours.
294. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
314. **Production.** Introduction to production management, consideration of major problems of the production area, and the use of quantitative methods for solving them. Prerequisite: Business Administration 374 or consent of instructor. 3 hours or ½ unit.
315. **Management in Manufacturing.** The application of production concepts and quantitative techniques to actual industrial problems; the mathematical structure of the particular production problems; the general structure of the production system and its interaction with marketing and budgeting; and areas including inventory control, production processes, programming, production control, forecasting of production levels, simulation of the production system, and physical planning of industrial plants. Prerequisite: Business Administration 314. 3 hours or ½ unit.
320. **Marketing Research.** Investigation of the development and applicability of information systems techniques to marketing problems; analysis of the marketing management

process; exploration of the underlying concepts related to the information needed to serve the process; and the demonstration of incorporation of information resources into the management function. Covers the use of behavioral sciences, research methods, social processes, and structure influences upon marketing activities, demographic variables, application of Bayesian decision theory, studies of promotional activity, simulation and programming models, planning models, and strategy formulation models which provide an analytical structure for the solution of marketing problems. Prerequisite: Business Administration 202. 3 hours or ½ unit.

321. **Industrial Social Systems, I.** Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environment; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210, Psychology 100 and 201, or consent of instructor. 3 hours, or ½ to 1 unit.
323. **Industrial Social Systems, II.** Understanding of complex organizations; particular attention to ways of dividing work, achieving coordination, and issues connected with change and adaptation. Prerequisite: Business Administration 321; Psychology 201. 3 hours, or ½ to 1 unit.
337. **Promotion Management.** Designed to enable the student, through directed and supervised investigation of selected psychological, economic, and sociological problems, to become acquainted with the methods of demand analysis and its application to the interrelationships of marketing management, advertising management, and sales management; discussion of communication theory as it relates to the goals and means of winning patronage for the firm; and emphasis on the effect or control of the communication process. Class discussion focuses upon literature in demand stimulation and communications and the testing of relevant hypotheses. Prerequisite: Business Administration 202. 3 hours or ½ unit.
344. **Consumer Behavior.** Analysis of consumer motivation, buying behavior, market adjustment, and product innovation, including a survey of explanatory theories of consumer market behavior and produced reactions; behavioral aspects of the marketing process from the producer to ultimate user, or consumer; fundamentals of product planning, development, engineering, and promotion viewed as part of the total marketing program; consideration of normative models of the decision-making process for winning patronage in intermediate, industrial, and consumer markets; and the decision-making process by consumers evaluated with reference to psychological drives used by producers, middlemen, and consumers. Prerequisite: Business Administration 202. 3 hours or ½ unit.
351. **Personnel Administration.** Study of concepts and methods used by the staff personnel unit in building and maintaining an effective work force in an industrial organization; development of ability to design the personnel subsystem within the firm and to deal effectively with problems encountered in such areas as recruitment, selection, training, and wage and salary administration; and considerable emphasis on case analysis, role playing, and research. Credit is not given for Business Administration 351 and Psychology 245. Prerequisite: Business Administration 323; Economics 173 and 240. 3 hours, or ½ to 1 unit.
352. **Pricing Policies.** The essential nature of marketing decisions and pricing, marketing, organization and the pricing process, price theories, and pricing models; contributions of operations research and behavioral sciences to pricing analysis; and the relationship of pricing objectives, methods, strategies, and policies to market behavior and the goals of the firm. Prerequisite: Business Administration 202. 3 hours or ½ unit.
360. **Marketing Logistics.** The ecology, analysis, and development of integrated distribution systems; the application of quantitative tools, economic analysis, transportation and marketing management in the analysis, and interpretation and design of the physical flow of goods through marketing network alternatives; attention to the theory of market structures, transport networks, location, and cost control; and consideration of site

- selection, warehousing, inventory management, logistic communications networks, and data control models. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.
370. **International Marketing.** The role of enterprise, comparative marketing and transport institutions and systems, and comparative marketing organizations and systems of administration in selected foreign countries and the United States; the managerial and operational problems of world enterprise with emphasis on the role of ethnic and cultural differences in influencing marketing strategy. Prerequisite: Business Administration 202 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
373. **Business Information Systems.** Fundamentals of business data processing; consideration of the use of modern electronic computers in the areas of accountancy, economics, management, marketing, and general business. The facilities of the Digital Computer Laboratory are utilized. Prerequisite: Accountancy 266. 3 hours, or $\frac{1}{2}$ or 1 unit.
374. **Operations Research.** Introduction to methods of operations research from an executive or managerial viewpoint, emphasizing formulation of business problems in quantitative terms; industrial applications of linear programming, dynamic programming, game theory, probability theory, queueing theory, and inventory theory. Prerequisite: Business Administration 210 and Economics 173, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
375. **National Income and Business Forecasting.** Same as Economics 307. The significance of national income and related economic accounts for analysis and forecasting of business conditions; develops the interrelations between data systems used by government agencies and business concerns in program planning and current decision making; and introduces the use of models for solving problems in this area. Prerequisite: Economics 101 or equivalent; Economics 171 (for business majors, Business Administration 321 and 374). 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Management Science in Marketing.** The appraisal and diagnosis, organization and planning, action and control of commodity and product-service distribution, marketing analysis and systems, and demand stimulation; survey of normative models for decision making in a variety of marketing situations and systems; introduction to the behavioral theory of the firm and its application to different marketing targets, institutional settings, or market arrangements; discussion of the various analytical tools available to firms for appraising, diagnosing, organizing, planning, and formulating market strategies; and emphasis on principles of behavioral sciences and quantitative techniques. A terminal course that integrates the analysis of a wide range of marketing problems and situations. Prerequisite: Business Administration 320 and 337. 3 hours or $\frac{1}{2}$ unit.
389. **Business Policy.** Analysis of policy formulation and implementation from a company-wide standpoint; emphasis on integration of knowledge and approaches across functional areas; both endogeneous and exogeneous factors which affect company policies; and the role of the firm in society. Prerequisite: Business Administration 321 or 344; Business Administration 374; senior standing. 3 hours or $\frac{1}{2}$ unit.
391. **Introduction to Management Information Systems.** Same as Accountancy 391. Introduction to the fundamentals of information systems technology, techniques, and capabilities, particularly with respect to the use of information systems in an administrative setting. Prerequisite: Computer Science 105 or equivalent, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
392. **Information Organization for Management Information Systems.** Same as Accountancy 392. Data collection, classification, verification, and transmission; file organization, including sequential and random processing techniques, record locating, overflow procedures, and file security; analysis of alternative methods of data organization; commercial file management systems; design of data processing systems; and instruction in COBOL and use of case studies. Prerequisite: Accountancy/Business Administration 391 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
393. **Management Information System Development.** Same as Accountancy 393. Essential steps in developing a management information system, including preliminary planning, design, feasibility analysis, implementation schedule, and postimplementation re-

view of the system; includes a semester-long project which familiarizes students with methodology and techniques. Prerequisite: Accountancy/Business Administration 391 or 392, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

394. **Management Information and Control Systems.** Same as Accountancy 394. Integration of behavioral, quantitative, and system design concepts in relation to professional work in the management information systems area. Prerequisite: Accountancy/Business Administration 393 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
400. **Economic Analysis of the Firm.** Introduces the student with little or no background in economics to basic principles of analyzing the industrial structure and developing the marketing, financial, and general operating strategies of the firm in a dynamic economic system. Graduate credit is not given for Business Administration 400 and Economics 300 or 400. 1 unit.
401. **The Economic Environment.** Analysis of the functioning of the economy from an aggregative point of view; role of government policy in affecting the economic environment. Graduate credit is not given for Business Administration 401 and Economics 301 or 401. 1 unit.
408. **Foundations of Behavioral Science for Administration.** Develops and integrates fundamental behavioral concepts and theory having administrative applications; initially focuses on the individual decision maker and ultimately includes interpersonal, organizational, and social structures and influences; and develops strategies and methods of research on behavioral applications in business. 1 unit.
409. **Organizational Behavior.** Same as Labor and Industrial Relations 409. Examination and analysis of the organization as a social system and the impact of its various components on work attitudes and behavior; topics include the development of organizational structures, organizational effectiveness, decision making and policy formulation, leadership, and change. Prerequisite: Business Administration 408. 1 unit.
410. **Organizational Sciences, I.** Same as Political Science 460, Psychology 453, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; in addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or consent of instructor. 1 unit.
411. **Problems of Personnel Management.** Same as Labor and Industrial Relations 448. Examination of the organization and administration of the personnel function in management; the relations of personnel administration to operating departments and the scope of business and industrial personnel services; analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, carried out through case studies and direct industrial contracts; and specific consideration given to problems up to and including placing the person on a job. Prerequisite: Consent of instructor. 1 unit.
412. **Organization and Its Environment.** Analysis of business organizations adapting to shifts in internal and external elements; major emphasis on (1) the business firm as a part of a complex socioeconomic system; (2) the effects of government, labor unions, and political, religious, and business organizations on the executive's decision problems; (3) environmental factors conducive to organizational change; and (4) organizational growth. Prerequisite: Business Administration 409. 1 unit.
413. **Behavioral and Organizational Decision Making.** Examination of the major types of organization theory; use of organization theory to guide research and to make business decisions; and examination of major research methods used to study business organizations. Prerequisite: Business Administration 412. 1 unit.
415. **Foundations of Consumer Behavior.** Study of basic factors influencing consumer behavior; attention to psychological, sociological, and economic variables, including motivation, learning, attitude, personality, small groups, social class, demographic factors, and culture, in order to analyze their effects on purchasing behavior. 1 unit.

416. **Consumer Information Processing.** Analysis of information flows between buyer and seller; informational properties of demand stimulation strategies considered from the viewpoints of the firm, the consumer, and society; and consumer decision making examined by drawing upon the psychology and sociology of buyer motivation and social influence. Prerequisite: Business Administration 415. 1 unit.
420. **Marketing.** An introductory analysis of the marketing system, its operations, and the mechanisms for coordinating these operations; study of relationships of the firm to other firms and other institutions in the marketing system; analysis of the effects of such relationships on the nature of decision problems of the individual business; and discussion of the firm's problems in developing an integrated marketing program, and the specific problem areas of price, channel, location, sales, and market development. 1 unit.
421. **Marketing Strategy: Theoretical Foundations.** A formal analysis of strategy drawing on concepts from the theory of games, decision theory, value theory, and information theory; topics cover elements of game models, classes of decision problems, games against nature, modern utility theory, information theory, group decision making, statistical decision theory, and linear and nonlinear optimization. 1 unit.
422. **Marketing Strategy: Decision Models.** The role of models in the design, implementation, and adjustment of seller strategy; application of simulation, programming, and other methods to the specification and solution of product, price, promotion, and other marketing problems; and topics including the nature of models and model building, forecasting models, optimization models, and other decision models. Prerequisite: Business Administration 421. 1 unit.
424. **Market Segmentation.** Consideration of unique subsets of a group of potential customers and industrial buyers that may differ in accessibility of behavior from the aggregate market; an historical perspective of market segmentation, alternative bases of segmentation, the role and methods of market segmentation research, and the application of segmentation to marketing decision making. Prerequisite: Business Administration 420 or consent of instructor. 1 unit.
425. **Product Management.** The decisions on the firm's total market offer, including such topics as use of market analysis in making decisions on assortment, product development, pricing, packaging, branding, and sales forecasting; coordination of these decisions and actions with market communications, physical movement, production, finance, and the overall goals and policies of the firm; and emphasis on the use of analytic and research methods in making assortment and product decisions. 1 unit.
426. **Marketing Theory and Systems.** A detailed study of macro- and micro-marketing systems and the various approaches to marketing theory; attention given to general systems theory, the nature of marketing systems, system adaptation to the environment, concepts of theory, and major approaches to macro- and micro-theory in marketing. 1 unit.
430. **Research Methodology.** Introduction to social science research methods for use in business research, both scientific and professional; review, analysis, and criticism of the use of various research methods; and discussion of experimental and survey research, logic of research, and various techniques. Includes a student research project. 1 unit.
431. **Survey Methods in Marketing Research.** Same as Sociology 474. Analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Economics 171 or equivalent. 1 unit.
432. **Multivariate Methods.** The use of multivariate statistical methods in marketing research; topics covered include multiple regression and correlation, analysis of variance and covariance, canonical correlation, discriminant analysis, factor analysis, and simultaneous methods such as two-stage least squares and limited information one-maximum likelihood. Prerequisite: Economics 470. 1 unit.
433. **Experimental Design.** Training in the design, execution, and interpretation of field and laboratory experimental research; emphasis on the evaluation of alternative de-

signs, execution of problems, and interpretation of data; and a review of illustrative research studies made, an actual study designed, and data collected and interpreted. 1 unit.

435. **The Sampling of Human Populations and Social Organizations.** Same as Sociology 485 and Psychology 485. Procedures for selecting samples from and estimating population parameters for human populations and social organizations; types of sample designs treated include simple random samples, stratified, and cluster samples together with random number and systematic selection techniques; and emphasis given to the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or consent of instructor. 1 unit.
440. **Written Analysis.** Develops the student's ability in writing reports based upon analysis of cases and the conclusions reached; a threefold objective: (1) to improve the student's capacity to write effectively; (2) to contribute to the sharpening of analytic skills; and (3) to help integrate the knowledge learned in the functional fields. Prerequisite: Enrollment in a graduate program. ½ unit.
442. **Social Performance of Business and Government.** The position of the business enterprise as an institution in American society; the role of the businessman in that society. Prerequisite: Completion of the first year of the M.B.A. program or equivalent. 1 unit.
443. **Legal Aspects of Management Decisions.** The legal environment in which business decisions are made, including the legal system and the role of courts, government taxation and regulation of business, administrative law, antitrust law, labor law, and trends in the law affecting business policy. 1 unit.
444. **Policy and Planning.** Policy construction and planning of policy implementation at the executive level; case studies of company-wide situations from the management point of view; and integration and application of material from previous courses. Credit is not given for both Business Administration 444 and 389. Prerequisite: Business Administration 408, 420, 451, and 467, or equivalent. 1 unit.
451. **Financial Management.** An introduction to financial decision making in the firm; development of a decision-making framework for determining the most efficient allocation of resources within the firm; and emphasis placed on the analysis of capital investment projects, long-term sources of funds, and short-term financing problems. 1 unit.
452. **Long-Term Financial Decision Making.** Same as Finance 452. An analytical approach to the theoretical and applied aspects of decision making in business finance; assumes a long-term planning horizon; and emphasizes valuation and cost of capital theories, capital investment decisions, risk analysis, and capital structure and dividend policies. Prerequisite: Finance 254 or Business Administration 451, or equivalent; Economics 470, Business Administration 472, or concurrent registration in either course. 1 unit.
453. **Working Capital Management.** Same as Finance 453. A study of working capital management processes and of theoretical linkages between working capital and long-run financial management; uses a variety of models to study the theory of working capital management and to analyze relationships among variables in the short-run financial decision-making process; and combines theory and applications to provide insight into the total financial decision-making process. Prerequisite: Finance 254 or Business Administration 451, or equivalent; Economics 470, Business Administration 472, or concurrent registration in either course. 1 unit.
455. **Risk Management and Control.** Same as Finance 470. Analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses; techniques for risk and loss control; models for risk management decision making; and procedures for administering risk management policy relating to nonspeculative (insurable) risk. Prerequisite: Business Administration 452 and 460, or equivalent, or consent of instructor. 1 unit.

457. **Security Analysis and Investment Management.** Same as Finance 457. Application of decision theory and quantitative methods to problems of individual security valuation and selection, portfolio composition, and investment management. Prerequisite: Finance 254 or equivalent, or Business Administration 451 or equivalent. 1 unit.
458. **Portfolio Theory.** Same as Finance 458. A theoretical and research-oriented course related to the problems of efficient allocations of resources in security portfolios of large financial institutions; integration of interdisciplinary problems such as capital market price behavior and stock price behavior with portfolio analysis models. Prerequisite: Business Administration 457 or equivalent. 1 unit.
460. **Managerial Accounting and Control.** Analysis of managerial controls, the information needed for their operation, and the manner in which accounting provides that information; emphasis on accounting as a tool of management; and problems and cases stressing the type of figure information relevant to managerial decisions and the methods of using such data. 1 unit.
467. **Production Management.** An introductory course in decision-making problems in production; includes the theoretical foundations for production management as well as the applications of decision-making techniques to production problems in the firm; and considers production processes, plant layout, maintenance, scheduling, quality control, and production control in particular. 1 unit.
468. **Production Planning and Control.** In-depth treatment of decision-making topics in production at the factory manager level and above; topics include the development of generalized decision rules and systems analysis in production; and particular emphasis on the design of production control, quality control, and inventory control systems, and how each of these systems is integrated into the firm as a whole. Prerequisite: First year of the M.B.A. program. 1 unit.
469. **Quantitative Techniques in Production.** An advanced course in the application of quantitative techniques to decision-making problems dealing with production in the firm; topics include structural estimation of production systems, application of operations research techniques to production problems, and computer simulation of decision systems. Prerequisite: Business Administration 468 or equivalent. 1 unit.
470. **Mathematical Analysis for Management Decisions.** An elementary course in calculus with applications to business and economics; topics include differentiations, integration, Lagrange multipliers, multivariate functions, and matrices. 1 unit.
472. **Modern and Classical Statistics for Management Decisions.** The application of classical and modern statistics for business decision making. The level of the course assumes some prior knowledge of basic statistics as well as facility with elementary calculus. Prerequisite: Business Administration 470. 1 unit.
473. **The Quantitative Analysis of Decisions.** Introduction to operations research techniques; topics include the construction and solution of linear models under certainty, and the construction of probabilistic models, specifically queueing theory, Markov chains, and sequential decisions. Prerequisite: Business Administration 470. 1 unit.
474. **Applications of Operations Research Techniques.** The application of the operations research techniques developed in Business Administration 473 to practical business problems. Most of the semester is devoted to a series of field research studies. A review of previous work in the field is made prior to the field studies, and the role of the computer in solving operations research problems and its application to the field research is also a major consideration. Prerequisite: Business Administration 473. 1 unit.
475. **Systems Modeling and Simulation.** Same as Computer Science 445. Theory and techniques of simulation and gaming; simulation languages such as GPSS, DYNAMO, and SIMSCRIPT. Applications: investigation, control, and design of various systems (inventory, production scheduling, computer, marketing, and others). Prerequisite: Computer Science 105 or Mathematics 363 or Business Administration 374, or equivalent, or consent of instructor. 1 unit.
476. **Business Forecasting and Econometrics.** Introduction to maximum likelihood estimation techniques; topics including the use and limitations of least squares, two-stage least

squares, limited-information and full-information estimates; and consideration of problems with observational errors, multicollinearity, and autocorrelation in time-series and cross-section structural estimation. A major portion of the course is devoted to the application of the econometric techniques in business forecasting and analysis. Prerequisite: Business Administration 472. 1 unit.

477. **Economics of Decision Making.** The operational analysis of the problems of individual decisions under uncertainty that arise in the practice of management. Prerequisite: Business Administration 472. 1 unit.
478. **Stochastic Models in Management Science.** Application of Markov processes to describe, analyze, and design systems of interest in management science, including queues, inventory, production, brand loyalty, stock market, and other applications. Prerequisite: Mathematics 361 or 363, or equivalent. 1 unit.
479. **Mathematical Programming for Management Science.** Mathematical programming models (linear, integer, quadratic, nonlinear, dynamic, and combinatorial) used to describe, analyze, and design systems such as production, transportation, scheduling, and planning. Prerequisite: Mathematics 315 or equivalent. 1 unit.
482. **International Business Operations, I.** An integration of economics and the functional areas of business focused on the problems of managing international business operations; study of economic, legal, functional, and administrative problems through cases and literature emphasizing financial and marketing problems. Students select one area from the following for special study and reporting: Europe, Latin America, Africa, Middle and Near East, or South Asia and Far East. Prerequisite: Completion of first year of the M.B.A. program. 1 unit.
483. **International Business Operations, II.** Continuation of Business Administration 482. Prerequisite: Business Administration 482. 1 unit.
490. **Seminar in Business Administration.** Special topics in the general area of business. Topics are selected by the instructor at the beginning of each semester. 1 unit.
491. **Seminar in Special Topics.** Lectures in topics of current interest not covered by regular course offerings. Subjects are announced in the *Timetable*. Prerequisite: Consent of instructor or head of department. $\frac{1}{4}$ to 1 unit.
493. **Research in Special Fields.** $\frac{1}{4}$ to 2 units.
494. **Independent Study and Research.** Directed reading and research. $\frac{1}{2}$ or 1 unit.
499. **Dissertation Research.** Required of all students writing doctoral dissertations in business administration; guidance in writing theses and seminar discussions of interim progress reports. 0 to 4 units.

BUSINESS AND TECHNICAL WRITING

(See English under Humanities, School of)

CATALAN

(See Spanish, Italian, and Portuguese under Humanities, School of)

CERAMIC ENGINEERING

Head of Department: Professor A. L. Friedberg

Department Office: 204 Ceramics Building, Urbana

190. **Topics in Ceramic Engineering.** Provides an opportunity for freshmen to become acquainted with ceramic engineering; involves discussions and demonstrations on ceramic materials, processes, and properties; laboratory involves making ceramic articles, glasses, ceramic magnets, and coatings; and discussions include environmental concerns of the ceramic industries as well as the economic structure of these industries. For 2 hours credit, the student will prepare, individually, special glasses and ceramic articles, and measure specific properties. 1 or 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Ceramic Crystal Chemistry.** Crystal structure and crystal chemistry of ceramic materials, including the structure of silicates; geometrical crystallography and discussions of crystal character and crystal growth of ceramic materials. 3 hours.
202. **Ceramic Materials and Processes.** Characterization of ceramic raw materials and their preparation, fabrication, and processing. Prerequisite: Sophomore standing. 3 hours.
205. **Phase Equilibria in Ceramic Systems.** The concepts, interpretations, and utilization of phase equilibrium diagrams in multicomponent ceramic systems at high temperatures; methods of determining equilibrium relationships; and interpretation of binary, ternary, and quaternary systems emphasizing quantitative calculations, metastability, and the origin of microstructure. Lecture and discussion. Prerequisite: Concurrent registration in Chemistry 245 or consent of instructor. 3 hours.
208. **Thermal Processing.** The application of the principles involved in drying and high-temperature operations utilized in processing ceramic materials. Prerequisite: Junior standing in ceramic engineering. 3 hours.
216. **Rate Processes in Ceramic Engineering.** Reaction kinetics of ceramic processes; high-temperature phase transformations, sintering and grain growth, nucleation and crystal growth from melts; and mechanisms of material transport in solid and liquid systems. Prerequisite: Chemistry 245; junior standing in ceramic engineering. 3 hours.
221. **Pyrometry.** Principles and methods used in high-temperature measurement and introduction to process temperature control. Prerequisite: Junior standing in engineering or equivalent. 2 hours.
271. **Design of High-Temperature Systems.** Design for dryers, kilns, and furnaces for ceramic facilities. Prerequisite: Ceramic Engineering 208; Theoretical and Applied Mechanics 221. 3 hours.
272. **Ceramic Engineering Design.** Design of special equipment for ceramic fabrication processes; factory planning and layout. Prerequisite: Ceramic Engineering 208 271; 2 hours.
297. **Senior Seminar.** Lectures and discussions dealing with professional practice, job selection, employment practice, continuing education, professional growth, and economics of the ceramic industries. Prerequisite: Senior standing in ceramic engineering. 1 hour.
298. **Special Problems.** Special topics in ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. Prerequisite: Senior standing. 1 to 2 hours. May be repeated to a maximum of 2 hours.
299. **Senior Thesis.** Research in ceramics and ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. To receive credit, a thesis must be presented. Prerequisite: Senior standing; grade-point average of 4.0 or better. 1 to 5 hours. May be repeated for a maximum credit of 5 hours and a minimum credit of 3 hours.
307. **Thermal and Mechanical Properties of Ceramic Materials.** Interpretations of the thermal and mechanical behavior of real ceramic materials utilizing the atomistic concepts of structure correlated with characterized microstructure. Half of the course treats the

mechanism of thermal dilation, heat transport, and emission; the remainder integrates the characterization of deformation, including elastic, anelastic, plastic, and viscous behavior. Temperature dependency is stressed throughout. Lectures and laboratory. Prerequisite: Ceramic Engineering 216 and 331, or equivalent; Theoretical and Applied Mechanics 221. 3 hours or $\frac{3}{4}$ unit.

309. **Whiteware Materials.** The composition and properties of the wide variety of glazes and bodies used in the whiteware field; special emphasis on the single and multioxide component bodies including the structure and properties of the alkaline earth titanates and the ferritic spinels. Prerequisite: Ceramic Engineering 205. 3 hours or $\frac{3}{4}$ unit.
310. **Refractory Technology.** Engineering properties and thermochemistry of polycrystalline materials for use at elevated temperatures including processing of raw materials and the manufacture, heat treatment, quality control, and specification of refractory products; particular emphasis on oxides, silicates, carbides, borides, cermets, and refractory metals with a correlation of the properties of those materials to certain design criteria. Includes laboratory if taken for 1 unit of graduate credit. Prerequisite: Senior standing in engineering. 3 hours, or $\frac{3}{4}$ or 1 unit.
311. **Ceramic X-Ray Analysis.** X-ray diffraction for phase identification, for the determination of crystalline lattice parameters, and for the determination of the thermal expansion of crystalline solids; analytical methods of indexing powder diffraction patterns; the determination of precise lattice parameters by means of computer programming and high-temperature x-ray techniques. Prerequisite: Computer Science 101 and senior standing in engineering, chemistry, or geology, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Porcelain Enamels.** The engineering properties of porcelain enamel materials with emphasis on the fundamentals of composition; the proper smelting, preparation, and firing of coatings; and the evaluation of the physical and chemical properties of porcelain enamels; lecture and laboratory. Prerequisite: Junior standing in engineering. 3 hours or $\frac{3}{4}$ unit.
314. **Chemistry and Technology of Glass.** Glass structure and constitution and their relationship to chemical, physical, and electrical properties; melting, forming, and annealing operations; preparation of glasses and measurement of important glass properties; lectures and laboratory. Prerequisite: Junior standing in engineering, chemistry, physics, or geology. 3 hours or $\frac{3}{4}$ unit.
320. **Advanced Porcelain Enamels.** An advanced study of the field of porcelain enamels with particular emphasis on fundamentals of adherence in enamel-metal systems, on opacity and mechanism of color development and measurement, and on the thermal and chemical properties of coatings on metal; specific attention given to coatings for use on metals at elevated temperatures. Prerequisite: Ceramic Engineering 312 or consent of instructor. 2 to 3 hours, or $\frac{1}{2}$ to $\frac{3}{4}$ unit.
331. **Ceramic Microscopy.** Study of the optical activity in isotropic and anisotropic media with particular emphasis on the materials and products of ceramics; the application of these principles and related topics of optical microscopy to the study of the morphology, aggregation, size, and microstructure of the products of high-temperature thermochemical reactions and equilibria. Includes studies in thermal microscopy if taken for 1 unit of graduate credit. Prerequisite: Ceramic Engineering 205 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Electrical Ceramics.** Presentation of the subject of dielectric crystals and their electrical properties; discussion and correlation of ferroelectric and piezoelectric properties of several crystal classes; coverage in detail of the perovskite class of ferroelectric compounds; and discussion of spinel, garnet, and hexagonal type ferrimagnetic crystals and their properties. Prerequisite: Ceramic Engineering 309 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
388. **Nuclear Ceramics.** Same as Nuclear Engineering 388. Study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor; discussion of

material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in nonfissile ceramics, and nuclear carbon, graphite, and nonfuel ceramic isotope utilization. Prerequisite: Chemistry 245 or Physics 383, or consent of instructor. 3 hours or 1 unit.

401. **Ceramic Chemistry.** Silica, silicates, fusions, and phase relations. Prerequisite: Courses in chemistry and physics. 1 unit.
402. **Ceramics.** Chemical and physical phenomena. Prerequisite: Courses in physics and chemistry. 1 to 2 units.
405. **Glass Technology.** Following a brief review of unit processes and operations in glass manufacture, the course treats selected major topics relating to the glass preparation process and the chemical, mechanical, optical, and electrical properties of glass from a dominantly theoretical and research point of view. Prerequisite: Ceramic Engineering 314 or equivalent, or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
406. **Glass Technology.** Dominantly theoretical in approach. Following a survey of the basic theoretical ideas that have been used in the development of the glass model, student readings and reports from the classical and modern literature serve as the basis of class discussions on glass structure and behavior, with emphasis on structure property correlations. Prerequisite: Ceramic Engineering 405 or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
409. **Whiteware Materials.** Advanced study in the field of whitewares, including fundamental considerations of glazes and all types of ceramic bodies; special emphasis on new developments in research and processing; and attention given to the ferroelectric and ferromagnetic properties of electronic ceramics. Prerequisite: Ceramic Engineering 309. 1 to 1 $\frac{1}{2}$ units.
410. **Dielectric Properties of Ceramic Materials.** Review of fundamental properties of vector fields; consideration of the reaction of insulating solids to external electric fields in terms of dielectric theory; the properties of ceramic dielectrics including treatment of ferroelectrics in terms of present theory; and correlation of the piezoelectric properties of ferroelectric crystals and ceramics with the crystal structure, microstructure, and the ferroelectric properties. Prerequisite: Mathematics 345 and 343, or consent of instructor. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
412. **Structural Physical Ceramics.** Structural chemistry and crystallization behavior of ceramic systems at elevated temperatures; nucleation, and crystal growth; mineral synthesis; and high-temperature reaction kinetics including phase transformations and diffusion. $\frac{3}{4}$ or 1 unit. Extra contact hours will be arranged for students electing the course for 1 unit.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy 414 and Mining Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 or equivalent, or consent of instructor. 1 unit. Offered in alternate years.
418. **Physics of Strong Solids.** Characterization and interpretation of physical properties of single-phase and composite materials of high strength; covalently bonded semiconductors; transition-metal carbides; borides and nitrides; graphite; glass; fibers; and precipitation-hardened metals. Prerequisite: Any one of the following: Ceramic Engineering 307 or 421, Metallurgical Engineering 384, Chemistry 342 or Physics 490, or consent of instructor. 1 unit.
421. **Refractory Materials Engineering.** Interpretation of the behavior of materials for utilization in an environment where high-temperature structural stability and control of thermal energy transport are the prime considerations; emphasis on design and material selection criteria based on thermal energy control, mechanical stress response, and structural integrity at elevated temperature. Prerequisite: Ceramic Engineering 310 or consent of instructor. 1 unit.

461. **Mineralogy of Clays.** Same as Geology 461. The composition of various types of clays; the structure and properties of the clay minerals; and the origin and mode of occurrence of the clay minerals and clay materials. Field trip required. Prerequisite: Geology 336 or equivalent; consent of instructor. 1 unit.
462. **Mineralogy of Clays.** Same as Geology 462. The properties of clay materials, their relation to the structure of the clay minerals, and methods of determination and control; the utilization of clays in various arts and industries; and required field trip. Prerequisite: Ceramic Engineering 461. 1 unit.
495. **Materials and Special Problems.** Conference and laboratory. Prerequisite: Graduate standing in ceramic engineering. 0 to 2 units.
498. **Seminar in Ceramics.** Lectures on current ceramic research and development; presentations by visiting lecturers as well as graduate students and staff in the department. Registration required of all graduate students in ceramic engineering. Graduate students nearing completion of their theses are required to make a seminar presentation. Prerequisite: Graduate standing in ceramic engineering. 0 credit.
499. **Thesis Research.** Research in any of the branches of ceramics. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 311. 0 to 4 units.

CHEMICAL SCIENCES, SCHOOL OF

(Including Biochemistry, Chemical Engineering, and Chemistry)

Director of School: Professor H. S. Gutowsky

School Office: 106 Noyes Laboratory, Urbana

Biochemistry

Head of Department: Professor L. P. Hager

Department Office: 415 Roger Adams Laboratory, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
292. **Senior Thesis.** Limited in general to seniors in biochemistry and chemistry. Each student who desires to do thesis research must receive written permission from a member of the biochemistry faculty. Accordingly, prospective students are encouraged to contact the biochemistry staff in the semester prior to registration in this course. Students must present a thesis to receive credit in this course. Registration of 10 hours over two semesters is expected. Prerequisite: Biochemistry 350 and 355. 4 to 6 hours.
350. **Introductory Biochemistry.** The chemistry and metabolism of carbohydrates, lipids, proteins, nucleic acids, vitamins, and coenzymes and their relation to the regulation and processes of organisms, cells, and subcellular components. For nonconcentrators in biochemistry. Prerequisite: Chemistry 131 or 136, or equivalent. 3 hours or $\frac{3}{4}$ unit. Students may not receive credit for both Biochemistry 350 and the Biochemistry 352-353 sequence.
351. **Physicochemical Bases of Biochemistry.** Introduction to the physicochemical methods and ideas underlying biochemistry. Prerequisite: Chemistry 340 or equivalent course at the undergraduate level, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
352. **General Biochemistry.** Principles, chemistry, and methods of analysis of the composition and processes of living systems. Required for biochemistry concentrators. Students should not enroll in Biochemistry 352 without intent to take Biochemistry 353. Prerequisite: Chemistry 110, 122, or 336, or consent of instructor. 4 hours or 1 unit. Students may not receive credit for both the Biochemistry 352-353 sequence and Biochemistry 350.

353. **General Biochemistry.** Principles, chemistry, and methods of analysis of the composition and processes of living systems. Required for biochemistry concentrators. Prerequisite: Biochemistry 352 or consent of instructor. 4 hours or 1 unit. Students may not receive credit for both the Biochemistry 352-353 sequence and Biochemistry 350.
355. **Biochemistry Laboratory.** Introduction to experimentation with biochemical systems, processes, and compounds; identification and quantitative measurement of constituents and transformations in biological systems. Prerequisite: Chemistry 131 or 136, or equivalent; credit or registration in Biochemistry 350, 352, or 353, or equivalent. Quantitative analytical chemistry is recommended. 4 hours or 1 unit.
440. **Research Topics in Biophysical Chemistry.** Same as Chemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications; topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; and light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
452. **Experimental Techniques in Biochemistry.** Experiments concerning the detection, isolation, and characterization of macromolecules, including enzymes, antibodies, and nucleic acids; methods of studying the size, shape, and hydrodynamic properties of macromolecules and other compounds. Prerequisite: Biochemistry 355. $\frac{1}{4}$ to 1 unit. May be repeated for a maximum of $1\frac{1}{2}$ units credit.
455. **Biochemistry Seminar.** Discussions of current research and literature. Required of all graduate students whose major is biochemistry. Prerequisite: Biochemistry 350 and 355, or equivalent. $\frac{1}{2}$ unit.
490. **Special Topics in Biochemistry.** Designed for students majoring or minoring in biochemistry who wish to undertake individual studies of a non-Ph.D. thesis nature under the direction of a faculty member of the department. Prerequisite: Consent of head of department. $\frac{1}{4}$ to 4 units (summer session, $\frac{1}{4}$ to 2 units).
494. **Chemical Basis of Biological Specificity.** Same as Chemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; and metabolic interrelations of these molecules. Prerequisite: Chemistry 344 and 346, Biochemistry 352 and 353, or consent of instructor. $\frac{1}{4}$ to $\frac{3}{4}$ unit. May be repeated for a maximum of 2 units credit.
499. **Thesis Research.** 0 to 4 units.

Chemical Engineering

Head of Department: Professor J. W. Westwater

Department Office: 114 Roger Adams Laboratory, Urbana

161. **The Chemical Engineering Profession.** Lectures and problems on the history and scope of chemical engineering endeavors; decisions and criteria for process development and plant design. Prerequisite: Chemistry 101 or 107. 1 hour.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
261. **Introduction to Chemical Engineering.** Lectures and problems on material and energy balances. Prerequisite: Chemistry 102 or 108. 3 hours.
292. **Senior Thesis.** Limited in general to seniors in the curriculum in chemical engineering. Any others must have the consent of the head of the department. Each student taking the course must register in a minimum of 5 hours either in one semester or divided over two semesters. A maximum registration of 10 hours in two semesters is permitted. How-

ever, Chemical Engineering 390 (2 hours) may be substituted for 2 of the 5 hours required in Chemical Engineering 292. In order to receive credit, a thesis must be presented by each student registered in Chemical Engineering 292. 2 to 6 hours.

370. **Chemical Engineering Thermodynamics.** Fundamental concepts and laws of thermodynamics with emphasis on application to chemical engineering problems; introduction to phase equilibria. Prerequisite: Chemical Engineering 261. 3 hours or $\frac{1}{2}$ unit.
371. **Fluid Mechanics and Heat Transfer.** Introduction to fluid statics and dynamics; dimensional analysis: design of flow systems; and introduction to heat transfer conduction, convection, and radiation. Prerequisite: Chemical Engineering 261 or consent of instructor. 4 hours or 1 unit.
373. **Mass Transfer Operations.** Introduction to mass transfer processes and design methods for separation equipment. Prerequisite: Chemical Engineering 371 or consent of instructor. 4 hours or 1 unit.
374. **Chemical Engineering Laboratory.** Experiments and computation in fluid mechanics, heat transfer, reaction kinetics, and separation processes. Prerequisite: Credit or concurrent registration in Chemical Engineering 373. 3 hours or $\frac{1}{2}$ unit.
377. **Dynamics and Control of Chemical Systems.** Theory and experiments covering introductory topics in process dynamics and control with special emphasis on chemical systems, including mathematical modeling, system dynamics, feedback control, computer control, and analog simulation. Prerequisite: Chemical Engineering 371; Mathematics 345; Computer Science 101. 3 hours or $\frac{3}{4}$ unit.
380. **Heat, Mass, and Momentum Transport.** A unifying treatment of physical rate processes with particular emphasis on the formulation and solution of typical boundary value problems associated with heat, mass, and momentum transport. Prerequisite: Chemical Engineering 371 or consent of instructor; Mathematics 343 or 345. 3 hours or $\frac{3}{4}$ unit.
381. **Chemical Reaction Engineering.** Chemical kinetics, chemical reactor design, and the interrelationship of transport and chemical reaction in open and closed systems. Prerequisite: Chemical Engineering 373. 2 hours or $\frac{1}{2}$ unit.
382. **The Prediction of Physical Properties.** Prediction of equilibrium and transport properties in gases, liquids, and solids. Prerequisite: One year of physical chemistry. 2 hours or $\frac{1}{2}$ unit.
384. **Process Design.** Analysis and design of chemical process systems. Prerequisite: Credit or concurrent registration in Chemical Engineering 381. 1 to 3 hours, or $\frac{1}{4}$ to $\frac{3}{4}$ units.
386. **Introduction to Air Pollution.** Lectures and discussion of the sources, dispersion, reactions, and control of air pollutants. Prerequisite: Credit or concurrent registration in Chemical Engineering 373 or consent of instructor. 2 or 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit.
390. **Individual Chemical Engineering Projects.** Laboratory; development of an individual project. Prerequisite: Senior standing in chemistry or chemical engineering. 2 hours or $\frac{1}{2}$ unit.
396. **Special Topics in Chemical Engineering.** Study of selected topics in chemical engineering; content varies from semester to semester. Typical topics are optimization, chemical kinetics, phase equilibrium, biochemical engineering, kinetic theory, and transport properties. Prerequisite: Senior standing in chemical engineering or consent of instructor. 2 or 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
465. **Chemical Engineering Seminar.** Required of all graduate students whose major is chemical engineering. Prerequisite: Chemical Engineering 373. $\frac{1}{4}$ unit.
466. **Applied Mathematics in Chemical Engineering.** The development of mathematical models and a survey of modern mathematical methods currently used in the solution of chemical engineering problems; topics include the application of vectors and matrices, partial differential equations, numerical analysis, and methods of optimization in chemical engineering. Prerequisite: Consent of instructor. $\frac{3}{4}$ or 1 unit.
468. **Properties of Fluids.** The kinetic theory of gases and the prediction of transport coefficients; statistical mechanics applied to dense gases and liquids; and theories of solu-

- tions. Prerequisite: A background in modern physical chemistry and physics; consent of instructor. $\frac{3}{4}$ or 1 unit.
469. **Special Topics in Chemical Engineering.** Various advanced topics; generally taken during the second year of graduate study. Typical topics include turbulence, hydrodynamic instability, process dynamics, interfacial phenomena, reactor design, properties of matter at high pressure, and phase transitions. Prerequisite: Consent of instructor. $\frac{3}{4}$ or 1 unit. This course may be repeated.
487. **Fluid Dynamics.** Basic concepts in fluid dynamics with special emphasis on topics of interest to chemical engineers; derivation of the Navier-Stokes equations; solutions for creeping flow, for perfect fluids, and for boundary layers; non-Newtonian fluids; and turbulence. Prerequisite: Consent of instructor. 1 unit.
488. **Advanced Topics in Heat and Mass Transfer.** Principles of transfer operations developed in terms of physical rate processes; boundary layer heat and mass transfer, eddy diffusion, phase changes, and separation processes. Prerequisite: Consent of instructor. $\frac{3}{4}$ or 1 unit.
496. **Individual Study.** Study under the supervision of a staff member in areas not covered in course offerings. Prerequisite: Consent of the staff member under whom the study is to be made. 0 to 1 unit.
497. **Special Problems.** Individual work on problem-oriented projects not included in theses. This could be research, engineering design, or professional work in chemical engineering which has educational values. The work must be done under the supervision of a staff member with the approval of the department head. $\frac{1}{2}$ to 4 units.
498. **Research Seminar.** Discussion of recent developments of importance to different areas of chemical engineering research. The course is divided into a number of sections, and subject matter differs from section to section and from time to time. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated for credit.
499. **Thesis Research.** Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the Doctor of Philosophy. Not all candidates for this thesis work necessarily are accepted. Any student whose major is in another department must receive permission from the head of the Department of Chemical Engineering to register in this course. 0 to 4 units.

Chemistry

Head of Department: Professor H. S. Gutowsky

Department Office: 106 Noyes Laboratory, Urbana

100. **Introductory Chemistry.** Lectures, recitations, and audio-tutorial laboratory. For students whose preparation does not permit their enrollment in Chemistry 101 or 107. No previous credit in high school chemistry is presumed. Basic ideas, principles, and vocabulary of modern chemistry. Prerequisite: Two and one-half units in high school mathematics, or credit or concurrent registration in Mathematics 111 or 112. 2 hours.
101. **General Chemistry Lecture.** Lectures and recitations. For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry, and chemical equilibrium; descriptive chemistry of the elements and coordination compounds. Students may not receive credit for both Chemistry 101 and 107. Prerequisite: Credit in or exemption from Mathematics 111 or 112. 3 hours.
102. **General Chemistry Lecture.** Lectures and recitations. Chemistry of organic and biological substances, chemical energetics and equilibrium, and chemical kinetics and reaction mechanisms. Separate sections may be offered for students in biological and health sciences (with emphasis on biochemical systems) and for students in engineering and physical science (with emphasis on solids, crystals, and materials); see *Timetable* for sections currently offered. Students may not receive credit for both Chemistry 102 and 108. Prerequisite: Chemistry 101 or 107, or advanced placement credit for one semester

of college-level chemistry. Credit will not be given unless the student completes Chemistry 105 and 106, or Chemistry 104. 3 hours.

103. **General Chemistry: Organic Chemical Studies.** Lectures, recitations, and laboratory-discussion; descriptive facts and theory of organic chemistry and applications to living processes. For students in the College of Agriculture. A terminal course in chemistry; does not meet Chemistry 102 prerequisite for more advanced courses in chemistry. Prerequisite: Chemistry 101 and 105. 4 hours.
104. **General Chemistry Laboratory.** Laboratory and laboratory-discussion. Introduction to the techniques of the chemical laboratory, quantitative analysis, qualitative analysis, and synthesis. To be taken concurrently with Chemistry 102, this course provides a one-semester in-depth alternative to Chemistry 105 and 106. Students may not receive credit for Chemistry 104 and either Chemistry 105 or 106. Prerequisite: Chemistry 101 and credit or concurrent registration in Chemistry 102. 2 hours.
105. **General Chemistry Laboratory.** Laboratory and laboratory-discussion. Laboratory exercises to accompany Chemistry 101. Students may not receive credit for both Chemistry 105 and 104. Prerequisite: Credit in or exemption from Mathematics 111 or 112; credit or concurrent registration in Chemistry 101. 1 hour.
106. **General Chemistry Laboratory.** Laboratory and laboratory-discussion. Laboratory exercises to accompany Chemistry 102. Students may not receive credit for both Chemistry 106 and 104. Prerequisite: Chemistry 101 and 105; credit or concurrent registration in Chemistry 102. 1 hour.
107. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Students may not receive credit for both Chemistry 107 and 101. Credit toward graduation is received in Chemistry 107 only if Chemistry 109 is also completed. Prerequisite: One year of high school chemistry with at least a "B" average grade; credit or concurrent registration in Mathematics 120; concurrent registration in Chemistry 109. 3 hours.
108. **General Chemistry.** Lectures and recitations. For students in chemistry, chemical engineering, or physical science curricula. Credit toward graduation is received in Chemistry 108 only if Chemistry 110 is also completed. Students may not receive credit for both Chemistry 108 and 102. Prerequisite: Chemistry 107 and/or 109; concurrent registration in Chemistry 110. 3 hours.
109. **General Chemistry Laboratory.** Laboratory and discussions. To be taken with Chemistry 107. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without concurrent registration in Chemistry 107. 2 hours. Students with credit in Chemistry 101 may take Chemistry 109 for a maximum of 1 hour.
110. **General Chemistry Laboratory.** To be taken with Chemistry 108. Students with advanced placement or proficiency credit may, with the consent of the department, take this course without registration in Chemistry 108. 2 hours. Students with credit in Chemistry 102 may take Chemistry 110 for a maximum of 1 hour.
122. **Elementary Quantitative Analysis.** Stoichiometrical relations applied in volumetric and instrumental analysis: theory and practical application of theory in making chemical measurements. Prerequisite: Chemistry 102 or equivalent. 3 hours.
131. **Elementary Organic Chemistry.** Basic structural and synthetic organic chemistry is presented with emphasis on applications of this material to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Students may not receive credit for both Chemistry 131 and Chemistry 136. Prerequisite: Chemistry 102 or 108. 3 hours.
134. **Elementary Organic Chemistry Laboratory.** Basic laboratory technique in organic chemistry is presented with emphasis on experiments of interest to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary courses. Students may not receive credit for both Chemistry 134 and 181. Prerequisite: Credit or concurrent registration in Chemistry 131. 2 hours.

136. **Basic Organic Chemistry.** Fundamental structural, synthetic, and mechanistic organic chemistry is presented. For students whose major is chemistry or for those registering in the curriculum in chemistry or chemical engineering. Students may not receive credit for both Chemistry 136 and 131. Prerequisite: Chemistry 108 or 122; concurrent registration in Chemistry 181; Mathematics 130, 131, or 135. 3 hours.
181. **Structures and Synthesis.** A laboratory course emphasizing molecular structure and synthetic chemistry. Students may not receive credit for both Chemistry 181 and 134. Prerequisite: Chemistry 108 or 122; Mathematics 130, 131, or 135; credit or concurrent registration in Chemistry 136. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
245. **Physical Chemistry for Engineers.** Primarily for ceramists, metallurgists, and other engineering students; not offered to chemistry or chemical engineering majors. Provides the elements of chemical thermodynamics and chemical kinetics, and provides an introduction to the statistical concepts of entropy. Prerequisite: Chemistry 102; Physics 107 or 108; Mathematics 140 or 141, or equivalent. 3 hours.
292. **Senior Thesis.** Research, with thesis, under the direction of a senior staff member in chemistry. Normally the student takes two semesters of Chemistry 292 in the senior year. Chemistry 292 is recommended for all those who plan to do research and graduate study, and it or Biochemistry 292 is a prerequisite for graduation with distinction in chemistry. In the semester preceding their initial enrollment, those interested in taking the course should consult with their advisers and with the graduate adviser for the area of interest in which they plan to work. A maximum of 10 hours may be counted toward graduation and a thesis must be presented for credit to be received. 2 to 6 hours.
315. **Inorganic Chemistry.** Nuclear and extranuclear atomic structures and their relation to the properties of the elements and their compounds; types of bonding; survey of the periodic relationships; preparation and applications of the elements and their compounds. Prerequisite: Credit or concurrent registration in physical chemistry. 3 hours or $\frac{3}{4}$ unit.
316. **Inorganic Chemistry Laboratory.** Preparation of typical inorganic compounds illustrating special and advanced techniques, including characterization by modern physical methods. Prerequisite: Chemistry 383, or credit or concurrent registration in Chemistry 315, or equivalent. 3 hours or $\frac{3}{4}$ unit.
322. **Special Topics in Instrumental Analysis and Separation Methods.** Theory, practice, and instrumentation of gas, liquid, ion-exchange, gel chromatography, electrophoresis, mass spectrometry, combination GC-MS, nuclear magnetic resonance, electron spin resonance, Raman spectroscopy, and electron spectroscopy. Prerequisite: Credit or concurrent registration in Chemistry 340 or 342. 4 hours or 1 unit.
323. **Applied Electronics for Scientists.** A lecture and laboratory course designed expressly for chemists and other scientists or engineers who have little or no background in electronics, but who need a working knowledge of electronic devices, circuits, and instruments; begins with electronic principles and leads systematically into digital, analog, and servo systems used in scientific instrumentation. Prerequisite: Senior or graduate standing in any of the physical sciences or engineering, or consent of instructor. 4 hours or 1 unit.
328. **Principles of Environmental Chemistry.** Presentation of the chemical principles underlying air and water chemistry with strong emphasis on the behavior of environmental pollutants; detailed discussion of the chemistry of production of pollutants and their effects. Prerequisite: Chemistry 340, or Chemistry 336 and Physics 102, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
329. **Instrumental Methods in Environmental Science.** Designed to acquaint chemistry majors and nonmajors with the instrumental techniques used to analyze and characterize environmental samples with particular emphasis on the measurement of pollutant species; discussion of the following topics with emphasis on sample preparation and interpretation of results: electrochemical methods, UV/visible and IR spectroscopy, fluorimetry, atomic spectroscopy, mass spectrometry, activation analyses, microscopic

techniques, and chromatography. Prerequisite: Chemistry 229, or concurrent registration in Chemistry 340 or 342, or consent of instructor. 4 hours or 1 unit.

336. **Organic Chemistry.** Second course. Lectures and recitations. Prerequisite: Chemistry 131 and 134, or Chemistry 136 and 181. 3 hours or $\frac{3}{4}$ unit.
337. **Organic Chemistry.** Laboratory experiments in organic chemistry with emphasis on synthesis. Prerequisite: Credit or concurrent registration in Chemistry 336. 3 hours or $\frac{3}{4}$ unit.
338. **Separation, Purification, and Identification of Organic Compounds.** Separation, purification, and identification of organic compounds using modern research methods; the identification of organic compounds by the use of spectroscopic methods and chemical conversion; the separation of mixtures and the purification of the components by crystallizations, sublimation, distillation, extraction, and chromatography; and the qualitative and quantitative identification of the components of a mixture. Prerequisite: Chemistry 336 and 337. 4 hours or 1 unit.
339. **Advanced Organic Chemistry.** Interpretation of reactivity, reaction mechanisms, and intermediates; applications in organic synthesis, photochemistry, biosynthesis of natural products, and other areas. Prerequisite: Chemistry 338. 3 hours or $\frac{3}{4}$ unit.
340. **Principles of Physical Chemistry.** A one-semester course in physical chemistry emphasizing topics most important to students in the biological and agricultural sciences. Not open to students in the specialized curricula in chemistry and chemical engineering. Laboratory experience in this area provided by Chemistry 383 to be taken preferably after Chemistry 340. Prerequisite: Chemistry 122 and 131, or equivalent; Physics 102; Mathematics 130 or equivalent (calculus including partial derivatives). 4 hours or 1 unit.
342. **Physical Chemistry.** This course and Chemistry 344 constitute a year-long study of chemical principles, covering topics such as atomic and molecular structure, properties and thermodynamics of gases, liquids, crystals, phase equilibria, solutions, surface chemistry, chemical equilibrium, electrochemistry, chemical thermodynamics, and chemical kinetics. Students should not enroll in Chemistry 342 who do not intend to take Chemistry 344. Prerequisite: Chemistry 108, 122, or equivalent; Physics 106, 107, and 108, or two semesters of general physics with concurrent registration in the third semester; credit or concurrent registration in Mathematics 140 or equivalent. 3 hours or $\frac{3}{4}$ unit.
344. **Physical Chemistry.** Continuation of Chemistry 342. Prerequisite: Chemistry 342. 3 hours or $\frac{3}{4}$ unit.
346. **Physical Chemistry of Macromolecules.** The physical properties of systems containing large molecules, with special emphasis on proteins, nucleic acids, and high polymers; the use of physical methods for the characterization of such substances. Prerequisite: Chemistry 340 or 344. 3 hours or $\frac{3}{4}$ unit.
348. **Advanced Physical Chemistry.** The sequence, Chemistry 348 and 349, is designed to give seniors and graduate students a unified treatment of physical chemistry on an advanced level; topics include the electronic structure and spectra of atoms, principles of wave mechanics, experimental and theoretical aspects of the chemical bond in diatomic and polyatomic molecules, statistical thermodynamics, and chemical kinetics. Prerequisite: Chemistry 344 or equivalent. 4 hours or 1 unit.
349. **Advanced Physical Chemistry.** Continuation of Chemistry 348. Prerequisite: Chemistry 348. 4 hours or 1 unit.
383. **Dynamics, Structure, and Physical Methods.** Laboratory presenting the relationship of dynamics and structure with emphasis on the use of physical methods to follow the course of reactions. Prerequisite: Chemistry 181 or 134; credit or concurrent registration in Chemistry 342, or credit in Chemistry 340. 2 hours or $\frac{1}{2}$ unit.
385. **Chemical Fundamentals.** Laboratory with experiments on the fundamental physical nature of chemical phenomena. Prerequisite: Chemistry 342 and 383; credit or concurrent registration in Chemistry 344. 4 hours or 1 unit.

390. **History of Science with Particular Reference to Chemistry.** Prerequisite: Twenty hours of laboratory science. 2 hours or $\frac{1}{2}$ unit.
392. **Applied X-Rays.** Generation and detection of x-rays; absorption and scattering of x-rays by matter; crystals; crystal and molecular symmetry; techniques of x-ray diffraction; identification and analyses; and deduction of atomic positions. Prerequisite: Chemistry 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
397. **Radiochemistry.** Same as Nuclear Engineering 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
398. **Radiochemistry Laboratory.** Same as Nuclear Engineering 398. To accompany Chemistry 397. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. Laboratory and discussion. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
404. **Advanced Inorganic Chemistry Laboratory.** Specialized laboratory techniques; more difficult inorganic syntheses. Prerequisite: Credit or concurrent registration in one of the lecture courses in inorganic chemistry in the 400 series. $\frac{1}{4}$ to $\frac{3}{4}$ unit.
405. **Inorganic Chemistry Seminar.** Required of all graduate students whose major is inorganic chemistry. $\frac{1}{4}$ unit.
406. **Physical Inorganic Chemistry.** Qualitative description of the bonding in inorganic compounds; use of physical methods to provide information about the structure and reactions of inorganic compounds; and structures and reactions of inorganic compounds in solution. Prerequisite: Chemistry 315 and 344. 1 unit.
407. **Special Topics in Inorganic Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as organometallic chemistry, advanced ligand field theory and molecular orbital theory of inorganic compounds, kinetics and mechanisms of inorganic reactions, etc. Prerequisite: Chemistry 406 or consent of instructor. $\frac{1}{2}$ to 1 unit. May be repeated for credit.
421. **Spectrochemical Methods of Analysis.** Emission spectroscopy; Raman spectroscopy; mass spectrometry; ultraviolet, visible, infrared, and microwave absorption spectroscopy; and colorimetry, fluorimetry, interferometry, and polarimetry. Lectures and laboratory. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree. 1 unit.
422. **Electrical Methods of Chemical Analysis.** Polarography, potentiometric, amperometric, and conductometric titrations, and other selected topics. Lectures and laboratory. Prerequisite: Chemistry 344 or equivalent. 1 unit.
423. **Electron Microscopy.** Same as Biology 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission of electron microscopes and its modern variants, including lectures and demonstrations of modern high-vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics; consent of instructor. $\frac{1}{2}$ unit.
424. **Special Topics in Analytical Chemistry.** Recent advances in measurement science and the application of analytical chemistry to other sciences; designed to acquaint students with techniques and applications not covered in other courses. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit. May be repeated.
425. **Analytical Chemistry Seminar.** Required of all graduate students whose major is analytical chemistry. $\frac{1}{4}$ unit.
427. **Applied X-Rays: Crystallography.** Prerequisite: Training in physics and physical chemistry. $\frac{3}{4}$ unit.
429. **Electron Microscopy with Laboratory.** Same as Biology 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate sections to meet special needs of biologists, geologists, and those interested in electron

diffraction. Most theory lectures may be omitted by those enrolled or having credit in Biology 423 or Chemistry 423. Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics; two semesters of college mathematics; three semesters of chemistry; consent of instructor. 1 unit.

431. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on reaction mechanisms and synthesis. Prerequisite: Chemistry 336; one year of physical chemistry. 1 unit.
432. **Organic Chemistry.** Advanced survey of organic chemistry with emphasis on structure. Prerequisite: Chemistry 431 or 336. 1 unit.
433. **Organic Chemistry.** Special topics in organic chemistry. An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as natural product synthesis and biosynthesis, organic photochemistry, chemistry of special families of organic compounds, etc. Prerequisite: Chemistry 431 and 432, one of which may be taken concurrently. $\frac{1}{2}$ or $\frac{3}{4}$ unit. Two lectures per week are required for $\frac{3}{4}$ unit credit. May be repeated for credit.
435. **Organic Chemistry Seminar.** Current literature in organic chemistry. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
436. **Experimental Organic Chemistry.** A lecture course on research techniques in organic chemistry. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit.
440. **Research Topics in Biophysical Chemistry.** Same as Biochemistry 440. Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications; topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; and light scattering from macromolecules in solution. Prerequisite: Chemistry 344 or equivalent, or Chemistry 346, or Biochemistry 351. 1 unit.
441. **Thermodynamics and Statistical Thermodynamics.** Fundamentals of classical thermodynamics with emphasis on equilibrium and stability criteria; an introduction to equilibrium statistical mechanics with discussion of several ensembles and applications to ideal systems of interest to chemists; and introduction to nonequilibrium thermodynamics. Prerequisite: Chemistry 342 and 344, or equivalent. 1 unit.
442. **Statistical Mechanics.** Fundamentals of equilibrium statistical mechanics with selected applications to interacting classical fluids: dense gases, solutions, liquids, plasmas, and ionic solutions; introduction to nonequilibrium statistical mechanics and linear response theory. Prerequisite: Chemistry 348 and 441, or equivalent, or consent of instructor. 1 unit.
443. **Quantum Dynamics.** The quantum mechanical description of time-dependent processes, including discussions of the time-dependent Schrodinger equation, approximations, interaction of matter with radiation, wave packets, elastic and inelastic scattering, and relaxation phenomena. Prerequisite: Concurrent registration in Chemistry 348 or consent of instructor. 1 unit.
445. **Physical Chemistry Seminar.** Required of all graduate students whose major is physical chemistry. Prerequisite: Consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.
447. **Approximation Methods in the Quantum Mechanics of Collisions.** Designed for entering and higher graduate students; treats several approximation methods in the quantum mechanics of collisions, principally the semiclassical method; develops portions of theoretical mechanics and complex variables employed for handling semiclassical solutions; and considers elastic, inelastic, and reactive collisions. Prerequisite: Consent of instructor. 1 unit.
448. **Chemical Kinetics.** Chemical reaction and theory of rate processes. Lectures. Prerequisite: Chemistry 441 or consent of instructor. $\frac{3}{4}$ unit.
449. **Special Topics in Physical Chemistry.** An advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as molecular spectroscopy, sta-

tistical mechanics, radiation and hot-atom chemistry, molecular quantum mechanics, radio-frequency spectroscopy, advanced experimental methods, kinetics of irreversible processes and cooperative phenomena, etc. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. Students may register for credit more than once.

- 490. **Special Topics in Chemistry.** Designed for students majoring or minoring in chemistry who wish to undertake individual studies of a non-Ph.D. thesis nature under the direction of a faculty member of the department. Prerequisite: Consent of instructor and of head of department. Staff for the course is the same as for Chemistry 499. $\frac{1}{4}$ to 4 units.
- 493. **Advanced Electron Microscopy.** Same as Biology 493. Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, and the analysis and study of varied materials by use of transmission and/or scanning electron microscopes and by the techniques of electron diffraction. Open to qualified graduate students in all departments. Prerequisite: Biology 429 or Chemistry 429; consent of instructor. $\frac{1}{4}$ to $\frac{1}{2}$ unit.
- 494. **Chemical Basis of Biological Specificity.** Same as Biochemistry 494. Biological formation and interaction of large molecules; analysis of the structural features concerned with functional specificity in heteropolymers, viruses, and subcellular particles; nucleic acids and their role as genetic molecules; proteins in their role as genetic products with highly specific functions; and metabolic interrelations of these molecules. Prerequisite: Chemistry 344 and 346, Biochemistry 352 and 353, or consent of instructor. $\frac{1}{4}$ to $\frac{3}{4}$ unit. May be repeated for a maximum of 2 units credit.
- 496. **Carbon and Hydrogen Tracer Methodology.** Comprehensive study of the tracer methodology concerned with the use of carbon-13, carbon-14, hydrogen-2, and hydrogen-3 in chemical research. Prerequisite: Chemistry 337 or consent of instructor. $\frac{3}{4}$ unit.
- 499. **Thesis Research.** A candidate for the master's degree who elects research is required to present a thesis. A thesis is always required of students working toward the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in a department other than chemistry or chemical engineering must receive permission from the head of the School of Chemical Sciences to register in this course. 0 to 4 units.

CHINESE

(See Asian Studies)

CIVIL ENGINEERING

Head of Department: Professor C. P. Siess

Department Office: 1114 Civil Engineering Building, Urbana

- 195. **Introduction to Civil Engineering.** A civil engineering orientation course including historical developments, educational requirements, relation to science, professional practice, and specialties in the profession. Prerequisite: Sophomore standing in civil engineering. 1 hour.
- 199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
- 201. **Engineering Surveying.** Introduction to surveying and photogrammetry. Prerequisite: Civil Engineering 293; credit or registration in Computer Science 101. 4 hours.
- 205. **Construction and Route Surveying.** Principles of construction layout and route location; data collection; horizontal and vertical alignment; and earthwork. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.

214. **Properties and Behavior of Concrete.** Engineering properties of plain concrete; influence of cement, aggregates, water, and admixtures on the properties of fresh and hardened concrete; microstructure of cement paste and concrete; mix design; handling of fresh concrete; and behavior under various types of loading and environments. Laboratory practice is an important part of the course. Prerequisite: Theoretical and Applied Mechanics 224 or consent of instructor. 3 hours.
216. **Construction Engineering.** Introduction to the construction processes: contracting and bonding, planning and scheduling, estimating and project control, scientific productivity models, and construction econometrics. Prerequisite: Civil Engineering 292; credit or concurrent registration in Computer Science 101 and Civil Engineering 293. 3 hours.
220. **Materials for Transportation Facilities.** Materials for the construction of transportation roadways including soils, aggregates, soil-aggregates, bituminous materials, asphaltic mixtures, and stabilized soils; emphasis on properties, behavior, mixture analysis, and quality control. Prerequisite: Theoretical and Applied Mechanics 221 or consent of instructor. 3 hours.
221. **Analysis and Design of Roadways.** Behavior, performance, and structural design of roadways for highways, airfields, railroads, and rapid transit; topics also considered: environmental factors, maintenance, and pavement economics. Prerequisite: Credit or concurrent registration in Civil Engineering 280, or consent of instructor. 3 hours.
230. **Introduction to Transportation Engineering.** Introduction to engineering principles common to all types of transportation; historical development and present systems of transport; technoeconomic characteristics of airways, highways, pipelines, railroads, and waterways; coordination and integration; and planning for transport use. Prerequisite: Junior standing in engineering, architecture, or urban and regional planning, or consent of instructor. 3 hours.
231. **Introduction to Transportation Systems.** Consideration of the interaction between engineering, social, economic, and political conditions in planning and designing transportation systems; included in transportation system planning are concepts of forecasting traffic demand, network design, trip distribution, and evaluation of alternative systems for that demand. Prerequisite: Civil Engineering 230 and 292, or consent of instructor. 3 hours.
240. **Control of the Urban Environment.** Discussion of the quality of the urban environment and identification of the sources and causes of deterioration of this environment; discussion of effects of air pollution, water pollution, refuse disposal, housing and land-use planning, along with methods and programs for control. Prerequisite: Junior standing. 3 hours.
241. **Air and Water Quality.** Sources and types of air and water pollution; measurement of air and water quality; effects of pollutants on the environment; transport and ultimate fate of pollutants; environmental quality standards; and methods of pollution control and abatement. Prerequisite: Credit or concurrent registration in Theoretical and Applied Mechanics 235; Chemistry 102. 3 hours.
255. **Introduction to Hydrosystems Engineering.** Quantitative aspects of water in the earth's environment and its engineering implications, including design and analysis of systems directly concerned with use and control of water; presents a quantitative introduction to hydrology, hydraulic engineering, and water resources planning. Prerequisite: Civil Engineering 293 or a course in probability or statistics; credit or registration in Theoretical and Applied Mechanics 235 and Civil Engineering 292, or equivalent. 3 hours.
261. **Introduction to Structural Engineering.** Basic topics in the analysis, behavior and design of trusses and framed structures under static loads; analysis topics including member forces in trusses, shear and moment diagrams, deflections, simple applications of the force method and slope-deflection; and an introduction to computer applications by means of a general purpose structural analysis program. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.

262. **Analysis of Framed Structures.** Comprehensive study of the force and displacement of methods of analysis of framed structures; influence functions; curves of maxima; and use of computer structural analysis programs. Prerequisite: Civil Engineering 261. 3 hours.
263. **Behavior and Design of Metal Structures, I.** Introduction to the design of metal structures; behavior of members and their connections; and theoretical, experimental, and practical bases for proportioning members. Prerequisite: Civil Engineering 261 or consent of instructor. 3 hours.
264. **Reinforced Concrete Design, I.** Study of the strength, behavior, and design of reinforced concrete members subjected to moments, shear, and axial forces; extensive discussion of the influence of the material properties on behavior. Prerequisite: Civil Engineering 261. 3 hours.
280. **Introduction to Soil Mechanics and Foundation Engineering.** Classification of soils, compaction in the laboratory and in the field, soil exploration, boring and sampling, one-dimensional settlement analyses, strength, bearing capacity of foundations, and stability of retaining walls and slopes. Prerequisites: Theoretical and Applied Mechanics 221. 3 hours.
290. **Legal Aspects of Engineering Contracts and Specifications.** Same as General Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; and business and technical clauses of specifications. Credit is not given for both Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
292. **Design and Planning of Civil Engineering Systems.** Introduction to the synthesis and design of systems dependent upon civil engineering technology; the structuring, modeling, and simulation of such systems; and the role of the decision maker and the use of optimal principles in engineering planning. Prerequisite: Integral calculus. 3 hours.
293. **Stochastic Concepts in Civil Engineering.** Identification and modeling of nondeterministic problems in civil engineering, and the treatment thereof relative to engineering design and decision making; development of stochastic concepts and simulation models, and their relevance to real design and decision problems in various areas of civil engineering. Prerequisite: Integral calculus. 3 hours.
295. **Professional Practice.** A series of lectures by outstanding authorities on the practice of civil engineering and its relations to economics, sociology, and other fields of human endeavor. Lectures are given approximately once a week. Prerequisite: Junior standing. 0 credit.
297. **Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by the department. Prerequisite: Senior standing. 1 to 4 hours.
307. **Photogrammetric Engineering.** Study of metrical photography in civil engineering practice; analytical and analogue photogrammetric systems; photometrics and outer space mapping techniques; and automated photographic mapping systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
309. **Geodetic Engineering.** Geodetic positioning on a reference ellipsoid, least squares adjustment of first-order triangulation and trilateration nets using observation equations, satellite triangulation, principles and operations of modern instruments, geodetic leveling, map projections, and rational design of geodetic systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
315. **Construction Productivity.** Introduction to the application of scientific principles to the measurement and forecasting of productivity in construction engineering; conceptual and mathematical formulations of the labor, equipment, and material factors affecting productivity. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
316. **Construction Planning and Control.** Project definition; scheduling and control models; material, labor, and equipment allocation; optimal schedules; project organization;

- documentation and reporting systems; and management and control. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
318. **Construction Cost Analyses and Estimates.** Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; and the fundamentals of cost recording for construction cost accounts and cost controls. Prerequisite: Civil Engineering 216 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
321. **Bituminous Material and Mix Design.** Properties and control testing of bituminous materials; analysis of bituminous paving mixtures; and composition and design of asphaltic concrete and soil-asphalt mixes. Prerequisite: Civil Engineering 214 and 220, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
322. **Development of Highway Facilities.** Analysis of factors in developing a highway transportation facility; traffic estimates and assignment; problems of highway geometrics and design standards; planning and location principles; intersection design factors; street systems and terminal facilities; programming improvements; drainage design; structural design of surface; concepts of highway management and finance; and highway maintenance planning. Prerequisite: Civil Engineering 220 or consent of instructor. 4 hours or 1 unit.
325. **Highway Traffic Characteristics.** Vehicle operating characteristics, driver characteristics, pedestrian characteristics, and roadway characteristics; their individual and collective relationships as traffic stream characteristics to the planning, design, and operation of highway facilities. Prerequisite: Civil Engineering 230 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
333. **Urban and Regional Transportation.** Importance of transportation and its relation to urban and regional planning; characteristics of transport systems; transportation planning including surveys, data analysis, and problems of administration and finance; and coordination and integration of transport. Prerequisite: Senior or graduate standing, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
334. **Airport Design.** Basic principles of site selection for airports and fundamental considerations of design, construction, and maintenance of airport pavements and structures. Prerequisite: Civil Engineering 220 and senior standing in civil engineering, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **Railway Construction and Maintenance.** Loads and load distribution on track and subgrade; roadbed construction and stabilization; track stresses, design and materials; turnouts and crossings; and maintenance programs. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.
336. **Railway Location and Operation.** Influences of traffic, alignment, distance, gradients, and motive power upon operating expenses; mechanics of train operation; and economic design of location. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Signals.** Train movements; systems of signals; track circuits; track capacity; interlockings; and economics of signaling. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 2 hours, or $\frac{1}{2}$ or 1 unit.
338. **Terminals.** Design, location, and operation of freight terminal facilities for rail, highway, air, and water carriers; passenger terminals; special terminal requirements for specific commodity categories; and coordination with and relation to land use and urban planning. Prerequisite: Senior standing or consent of instructor; credit or concurrent registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or $\frac{1}{2}$ or 1 unit.
340. **Physical Principles of Environmental Engineering Processes.** Analysis of the physical principles which form the basis of many water and air quality-control operations; sedi-

mentation, filtration, inertial separations, flocculation, and mixing and principles of reactor design. Prerequisite: Civil Engineering 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

341. **Air Resources Management.** Examination of the management of the air resources for a large urban area using dynamic operational gaming simulation techniques; focus on the law, technology, administration, and politics associated with the control of air resources. Prerequisite: Senior or graduate standing, or consent of instructor and credit in an introductory course in air pollution control. 2 hours or $\frac{1}{2}$ unit.
342. **Water Quality Control Processes.** Fundamental theory underlying the unit processes utilized in the treatment of water for domestic and industrial usage, and in the treatment of domestic and industrial wastewaters. Prerequisite: Credit or concurrent registration in Civil Engineering 241. 3 hours or $\frac{3}{4}$ unit.
343. **Chemical Principles of Environmental Engineering Processes.** Application of principles of chemical equilibrium, surface chemistry, chemical kinetics, and photochemistry to air and water quality considerations; carbonate and phosphate systems in natural waters; dissolved gases; hardness; hydrolysis of coagulants; corrosion; chemistry of disinfectants; removal of impurities by adsorption; and reactions of various pollutants in the atmosphere. Prerequisite: Civil Engineering 342 or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
344. **Solid Wastes Management.** Analysis of the quantities, sources, and characteristics of solid wastes and associated trends; effects of refuse on the environment; establishment and operation of collection systems; transportation of refuse to disposal site; reclamation and reuse systems; and design of disposal systems and optimization of management systems. Prerequisite: Consent of instructor. 4 hours or 1 unit.
345. **Environmental Health Engineering.** Application of engineering principles to the control of environmental sanitation and communicable disease control, including administration, biostatistics, epidemiology, vector control, pesticides, milk and food sanitation, swimming pools, individual water supply and wastewater disposal, plumbing, refuse collection and disposal, industrial hygiene and air pollution, radiological health, and international health. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
346. **Biological Principles of Environmental Engineering Processes.** Application of principles of organic chemistry, biochemistry, and biology to air and water quality, wastes, and their engineering management; biologically mediated changes in water and in domestic and industrial wastewater; biological contaminants of air; and solid waste disposal. Prerequisite: Civil Engineering 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
347. **Aquatic Ecology.** Same as Zoology 359. An integrated study of the environmental factors affecting the composition and distribution of biota in lakes, rivers, and estuaries; emphasis on the nature of the response of aquatic ecosystems to stress, and practical means of aquatic resource management. Prerequisite: Credit or concurrent registration in Civil Engineering 346 or Zoology 343, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
348. **The Air Pollution System.** Same as Agricultural Engineering, Environmental Studies, General Engineering, Geography, Mechanical Engineering, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.
349. **Nuclear Radiation Protection.** Same as Nuclear Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry, sources of ionizing radiation, determination of radiation toler-

- ances, dosimetric instruments, and standards and regulations. Prerequisite: Nuclear Engineering 346 or 397, or equivalent, or consent of instructor. 4 hours or 1 unit.
350. **Hydrology.** An applied course on hydrology dealing with environmental water problems; discussion of principles of hydrologic systems and their components; and presentation of methods of analysis and their applications to various purposes of water resources planning and development. Prerequisite: Civil Engineering 255 or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
351. **Hydromechanics.** Applied fluid mechanics with particular reference to topics in hydraulic design, analysis, and research in civil engineering areas; dimensional analysis and dynamic similitarity, analysis of potential flow, boundary-layer problems, turbulence and diffusion, hydraulic transients, water waves, and transport phenomena. Prerequisite: Theoretical and Applied Mechanics 235 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
352. **Water Resources Design.** Study and evaluation of phases of river mechanics, water resources history and project implementation, and development of a water resources project plan. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
353. **Hydraulic Structures.** Introduction to the design of hydraulic structures; consideration of types and functions of dams; hydrologic design; hydraulic design of spillways and outlet works; determination of loads and stresses for concrete structures; and seepage, piping, and stability of earth structures. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
356. **Hydraulics of Surface Drainage.** Application of hydraulic and hydrologic principles; elements of channel design; hydrologic determination of design flow; flow through bridge openings and other obstacles; hydraulics of drainage areas; overland flow; runoff from highways, runways, and urbanized areas; hydraulics of storm-drain systems; and culvert design. Prerequisite: Civil Engineering 255 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
358. **Air Pollution and Combustion.** Same as Mechanical Engineering 333 and Aeronautical and Astronautical Engineering 335. Natural and man-made pollutants in the atmosphere; fundamentals of stoichiometry, reaction kinetics, and chemical equilibrium as applied to pollutants and their reactions in the air; and all combustion devices which make major contributions to air pollution, and current and possible control techniques for these devices. Prerequisite: Chemistry 102 and Mechanical Engineering 205 or 207, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
359. **Dynamics of Aerosols and Hydrosols.** Same as Mechanical Engineering 303. Theory and application of the basic relations of fluid dynamics, thermodynamics, and heat transfer to the motion of aerosols and hydrosols, with application to problems in air and water pollution. Prerequisite: Senior or graduate standing. 3 hours or 1 unit.
361. **Matrix Analysis of Framed Structures.** A unified formulation of displacement and force methods of analysis including the topological view of the structure as an assemblage of members; matrix techniques of formulation; considerations for automatic computation; and evaluation of truss, grid, and frame models for the response of real structures. Prerequisite: Civil Engineering 262. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Behavior and Design of Metal Structures, II.** Metal members under combined loads; welded and riveted connections; moment-resistant connections; and plate girders and plastic design concepts. Prerequisite: Civil Engineering 263 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
364. **Reinforced Concrete Design, II.** Study of the strength, behavior, and design of indeterminate reinforced concrete structures, with primary emphasis on slab systems; emphasis on the strength of slabs and on the available methods of design of slabs spanning in two directions, with or without supporting beams. Prerequisite: Civil Engineering 262 and 264. 3 hours, or $\frac{3}{4}$ or 1 unit.
365. **Design of Structural Systems.** The whole structural design process including definition of functional requirements, selection of structural scheme, formulation of design crite-

ria, preliminary and computer-aided proportioning, and analysis of response, cost, and value. Prerequisite: Civil Engineering 263 or 264, or equivalent. 3 hours or 1 unit.

- 368. Prestressed Concrete.** Study of strength, behavior, and design of prestressed reinforced concrete members and structures, with primary emphasis on pretensioned, precast construction; emphasis on the necessary coordination between design and construction techniques in prestressing. Prerequisite: Civil Engineering 262 and 264. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 369. Behavior and Design of Wood Structures.** Mechanical properties of wood, stress grades and working stresses; effects of strength-reducing characteristics, moisture content, and duration of loading and causes of wood deterioration; glued-laminated timber and plywood; behavior and design of connections, beams, and beam-columns; design of buildings and bridges; other structural applications: trusses, rigid frames, arches, and pole-type buildings; and prismatic plates and hyperbolic paraboloids. Prerequisite: Civil Engineering 261 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 370. Structural Reliability and Probabilistic Bases of Design.** Modern probabilistic bases for the design and evaluation of structures and systems, including analysis of structural safety and reliability, and development of probability-based design criteria; quantitative risk evaluation, systematic assessment and analysis of uncertainties, safety and load factor determinations, and risk analysis and design for wind storms and earthquakes. Prerequisite: Civil Engineering 261 and 293, or equivalent, or graduate standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
- 374. Introduction to Structural Dynamics.** Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multidegree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility. Credit is not given for both Civil Engineering 374 and Theoretical and Applied Mechanics 311. Prerequisite: Theoretical and Applied Mechanics 212; Mathematics 345; Civil Engineering 261, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 375. Welding and Joining Processes.** Same as Metallurgical Engineering 301. The physical principles of fusion welding; heat flow; thermal cycles; physical metallurgy and mechanical properties of welded joints; applications of welding to large structures; testing of welds; nondestructive testing; design, economics, and weld specifications; and laboratory experiments in welding. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 378. Introduction to the Design of Ocean Structures.** Introduction to design and construction of civil engineering structures in the ocean and to associated engineering operations; principal topics include water wave mechanics, engineering oceanography, wave and current forces, and design considerations for fixed and floating structures. Prerequisite: Theoretical and Applied Mechanics 235; Civil Engineering 261; Civil Engineering 293. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 379. Applied Structural Mechanics.** Study of beams under lateral load; beams with combined lateral load and thrust; beams on elastic foundations; applications of Fourier series and virtual work principles to beam-type structures; stress and strain in three dimensions; applications to flexure of beams and plates; elements of the engineering theory of plates; and torsion of thin-walled open sections. Prerequisite: Mathematics 345 and Civil Engineering 262. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 383. Soil Mechanics and Soil Properties.** Index properties and engineering classification; water flow and hydraulic properties; stress in soil; stress-strain properties of soils; consolidation; shear strength; properties of natural soil deposits; unsaturated soils; and experimental measurements. Prerequisite: Civil Engineering 280 or equivalent, or consent of instructor. 4 hours or 1 unit.
- 384. Applied Soil Mechanics.** Application of soil mechanics to foundations of buildings; stability of earth slopes; earth pressures and retaining walls; braced cuts; and damage due to construction operations. Prerequisite: Civil Engineering 383 or equivalent. 4 hours or 1 unit.

385. **Terrain Analysis.** Use of geologic and pedologic information and airphoto interpretation techniques in the analysis of terrain for engineering purposes, correlations among physiographic regions, soil regions, and engineering problems. Field trip; see *Timetable* for approximate cost. Prerequisite: Civil Engineering 280 or equivalent. 4 hours or 1 unit.
391. **Computer Methods in Civil Engineering.** Review of programming concepts; formulation and programming of numerical, data processing, and logical problems with applications from various branches of civil engineering; organization of programs and data; and development and use of problem-oriented programming languages in civil engineering. Prerequisite: Computer Science 101 or equivalent; senior or graduate standing in civil engineering; or consent of instructor. 3 hours or 1 unit.
392. **Network Methods in Civil Engineering.** Application of network models to the planning, design, and analysis of civil engineering systems; network algebra; potential networks; flow networks and networks governed by constitutive equations; and logic and data networks. Prerequisite: Civil Engineering 292 or graduate standing, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
393. **Engineering Decision and Risk Analysis.** Development of modern statistical decision theory and risk analysis, and application of these concepts in civil engineering design and decision making; Bayesian statistical decision theory, decision tree, utility concepts, and multiobjective decision problems; modeling and analysis of uncertainties, practical risk evaluation, and formulation of risk-based design criteria, risk benefit trade-offs, and optimal decisions. Prerequisite: Civil Engineering 293 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
394. **Optimization Models in Civil Engineering.** Emphasizes the use of mathematical programming models in civil engineering; develops linear programming, dynamic programming, and network flow techniques in depth and applies them to various civil engineering systems, primarily environmental engineering, transportation planning, construction management, and watershed development. Prerequisite: Civil Engineering 292 or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
405. **Analytical Aerotriangulation.** Iterative and simultaneous rigorous block adjustment methods, and numerical methods for the solution of large systems of equations; characteristics of various analytical photogrammetric systems. Prerequisite: Civil Engineering 307 or consent of instructor. 1 unit.
416. **Design of Construction and Industrial Operations, I.** Same as Industrial Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues, and inventory models required for systems design; and design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering, or credit or concurrent registration in Mathematics 363, or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Industrial Engineering 417. Continuation of Civil Engineering 416. Prerequisite: Civil Engineering 416 or Industrial Engineering 416; credit or concurrent registration in Mathematics 315; or consent of instructor. 1 unit.
420. **System Approach to Pavement Design.** Concepts of system approach; pavement function and performance; evaluation of surface properties and relation to vehicle performance; analysis of subsystems and principal components; composition and properties of pavement mixtures; and durability problems and controls. Prerequisite: Civil Engineering 220 or 221, or equivalent. 1 unit.
421. **Pavement Design, II.** Structural design of flexible and rigid pavements; loading characteristics and static, impact and repeated loads; load distribution through pavement layers, factors affecting distribution, and methods of analysis; evaluation of subgrade support; and criteria for selecting design values. Prerequisite: Civil Engineering 220 or equivalent. 1 unit.

- 422. Fundamental Properties and Behavior of Bituminous Mixtures.** Composition and theories of physical structure of bitumens; rheological, failure, durability, and adhesive properties of bitumens and bituminous mixtures; and analysis of factors influencing the performance of bituminous aggregate mixtures. Prerequisite: Civil Engineering 321 or consent of instructor. 1 unit.
- 423. Highway Materials Stabilization.** Stabilization of aggregates and soils with cement, lime, bituminous materials, and other stabilizing agents; emphasis on basic stabilization reactions, properties of stabilized materials, and composition design. Prerequisite: Civil Engineering 220 or consent of instructor. 1 unit.
- 426. Traffic Planning.** Traffic engineering planning functions; urban and rural master traffic plans; and traffic analyses for new or existing streets, highways, and terminal facilities. Prerequisite: Civil Engineering 325 or equivalent. 1 unit.
- 427. Geometric Highway Design.** Highway classification; highway capacity; highway design controls; sight distance; horizontal and vertical alignment; cross-section elements; highway types; controlled access highways; and design of at-grade intersections, grade separations, and interchanges. Prerequisite: Civil Engineering 325 and 426, or consent of instructor. 1 unit.
- 428. Traffic Engineering Operations.** Theory of traffic control; laws and ordinances; design and application of traffic control devices; special street designations; parking design and control; street illumination; and miscellaneous traffic control designs. Prerequisite: Civil Engineering 325 and 426, or equivalent. 1 unit.
- 435. Railway Construction and Maintenance.** Roadbed load capacity; economic design of track; advanced geometric design; economics of maintenance; grade crossing separations; and review of specific projects. Prerequisite: Civil Engineering 335. 1 unit.
- 436. Railroad Location and Operation.** Track and traffic capacity; optimum train size, performance, and scheduling; validity and accuracy of current practices; regional operating factors; and optimum size of plant and modern location. Prerequisite: Civil Engineering 336 or consent of instructor. 1 unit.
- 440. Water Treatment Processes.** Theory and basic design of the processes used in water treatment, including gas transfer, energy transfer, chemical precipitation, solids separation, disinfection, and solids disposal. Prerequisite: Credit or concurrent registration in Civil Engineering 340 and 343, or consent of instructor. 1 unit.
- 442. Wastewater Treatment Processes.** Composition and properties of wastewaters; theoretical considerations and design criteria for wastewater treatment and renovation processes, including chemical, physical, aerobic, and anaerobic biological processes, waste sludge disposal, and advanced waste treatment processes. Prerequisite: Civil Engineering 340 and 343, and credit or concurrent registration in Civil Engineering 346, or consent of instructor. 1 unit.
- 443. Unit Operations in Environmental Engineering.** Experimental and pilot plant studies of unit operations and unit processes in environmental engineering, emphasizing water treatment and wastewater treatment; evaluation of parameters for the design of biological waste treatment units; determination of chemical requirements for water treatment processes; and studies of anaerobic digestion. Prerequisite: Civil Engineering 440 or credit or concurrent registration in Civil Engineering 442, or consent of instructor. 1 unit.
- 444. Treatment of Industrial Wastes.** Basic concepts in approaching and solving industrial waste problems; theory and application of unit operations unique to the treatment of industrial wastes; and advanced considerations of wastewater problems and solutions of major industries. Prerequisite: Credit or concurrent registration in Civil Engineering 442 or consent of instructor. $\frac{1}{2}$ or $\frac{3}{4}$ unit.
- 445. Water Quality and Pollution.** Water quality standards and criteria for various beneficial uses; transport mechanisms for pollution in surface streams and ground water; and fate of pollution and pollution control. Prerequisite: Mathematics 345 and Theoretical and Applied Mechanics 235. 1 unit.

446. **Design of Water and Waste Treatment Plants.** Study of the fundamental factors affecting choice of treatment units and combination of unit processes into an integrated plant. Prerequisite: Civil Engineering 440 or credit or concurrent registration in Civil Engineering 442, or consent of instructor. 1 unit.
448. **Control of Air Pollution from Stationary Sources.** Same as Mechanical Engineering 411. Study of the basic theory of pollution control devices and their application to air pollution control problems. Prerequisite: Credit or concurrent registration in Civil Engineering 340 or 343, or consent of instructor. 1 unit.
449. **Analysis of Air Pollutants.** Same as Mechanical Engineering 412. Laboratory analysis of common air pollutants; theory of operation of laboratory and automatic field instrumentation. Prerequisite: Civil Engineering 343 or consent of instructor. $\frac{3}{4}$ unit.
450. **Hydrologic Systems.** Application of systems concepts to simulate and analyze hydrologic cycle and its components in terms of various deterministic, probabilistic, stochastic, lumped, distributed, linear, and nonlinear mathematical models for the purpose of planning and designing water resources projects. Prerequisite: Civil Engineering 350 or consent of instructor. 1 unit.
452. **Water Resources.** An advanced interdisciplinary course on water resources planning and development; geographic aspects; data collection; governmental functions; hydrologic implications; river hydraulics; hydraulic physical units and water quality; economic aspects; legal, political, and social problems; and case studies. Prerequisite: Consent of instructor. 1 unit.
455. **Transport Processes in Water.** Physical processes in transport by water, with emphasis on transport of pollutants; turbulent diffusion and longitudinal dispersion in pipes, rivers, and estuaries; stream reaeration; ocean outfalls; waste heat disposal; and dispersion in groundwater. Prerequisite: Mathematics 343 and 345, and Theoretical and Applied Mechanics 235, or consent of instructor. $\frac{3}{4}$ or 1 unit.
457. **Ground Water.** An advanced interdisciplinary course on ground water; hydrogeology; hydrodynamics of flow through porous media; ground water hydrology; hydraulics of wells; hydraulic analysis of seepage; ground water pollution; and ground water resources. Prerequisite: Consent of instructor. 1 unit.
458. **Open-Channel Hydraulics.** Basic hydromechanics; flow types; channel characteristics; flow-profile computations; hydraulic jump analysis; design of nonerodible, erodible, and grassed channels and transitional structures; study of supercritical flow and unsteady flow; modern developments in theory and design practice; and application of numerical method, method of characteristics, method of singular point, and electronic digital computers and analogs. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
463. **Optimization of Structures.** Structural design processes; formulation of problems in the optimization of structures; optimization of structural elements; minimum volume principles; and use of mathematical programming in optimization of structural systems. Prerequisite: Bachelor of Science degree in engineering with courses in structural analysis and design, or consent of instructor. 1 unit.
465. **Behavior of Structural Steel Frameworks.** Theories of ultimate behavior of metal structural members with particular emphasis on buckling and stability of members and frames; interpretation of research findings and specifications for bridge and building design. Prerequisite: Civil Engineering 263. 1 unit.
466. **Behavior of Reinforced Concrete Members.** In-depth study of the behavior of reinforced concrete members, including the relationships between behavior and building code requirements. Prerequisite: Civil Engineering 262 and 264. 1 unit.
467. **Behavior of Reinforced Concrete Structures.** Study of the strength and behavior of assemblages of reinforced concrete members, including a study of the applicability of traditional elastic design procedures to structures which exhibit inelastic behavior under the influence of both short and long term loadings. Prerequisite: Civil Engineering 466. 1 unit.

469. **Thin Shell Structures.** Fundamental membrane and bending theories of shells; application of theories to analysis and design of folded plates and cylindrical, rotational, and translational shells; membrane stresses and deflections; and approximate bending solutions by variational, finite-difference, and finite-element methods. Prerequisite: Civil Engineering 473 or consent of instructor. 1 unit.
471. **Numerical and Approximate Methods of Structural Analysis.** Numerical and approximate analytical procedures for the solution of complex problems with applications to bridges, buildings, and aircraft structures; solution methods for discrete and continuous equilibrium problems and eigenvalue problems. Prerequisite: Civil Engineering 379 or equivalent. 1 unit.
473. **Theory of Plates.** Classical plate bending theory; emphasis on methods of solution including series expansions, variational procedures, and finite element techniques applicable to plate-type structures commonly encountered in practice; and consideration of inplane loads, large deflections, buckling, and anisotropy. Prerequisite: Civil Engineering 262 and Mathematics 345. 1 unit.
474. **Dynamics of Framed Structures.** Advanced treatment of the dynamics of multidegree-of-freedom framed structural systems; fundamental concepts of eigenvalue theory of real matrices and energy principles of dynamics as bases for a unified approach to dynamical problems of structural assemblages; structural idealizations, principles of dynamics, Lagrange's equations, response calculations, normal mode method and its limitations, and transfer matrix approach; and computer utilization. Prerequisite: Civil Engineering 361 and 374, or equivalent. 1 unit.
475. **Behavior of Steel Structures.** Critical evaluation of the actual behavior of metals, connections, members, and structures; the significance of this behavior in terms of design and the development of design specifications. This course and Civil Engineering 465 form a unit in the study of theoretical and experimental investigations. Prerequisite: Graduate standing in civil engineering or theoretical and applied mechanics. 1 unit.
476. **Plastic Analysis and Design.** Basic concepts of limit analysis: plastic hinge formation; development and analysis of collapse mechanisms; inelastic behavior of metal structural frameworks: strength and stability under combined loadings; deflections; incremental collapse, and shakedown under variable repeated loading; application of plastic design to high-rise braced and unbraced steel frames; introduction to optimum design; and basis for application. Prerequisite: Credit or concurrent registration in Civil Engineering 465, or consent of instructor. 1 unit.
478. **Finite Element Methods in Solid and Structural Mechanics.** Theory and application of the finite element method; stiffness matrices for triangular, quadrilateral, and isoparametric elements; two- and three-dimensional elements; algorithms necessary for the assembly and solution; direct stress and plate bending problems for static, nonlinear buckling and dynamic load conditions; and displacement, hybrid, and mixed models together with their origin in variational methods. Prerequisite: Theoretical and Applied Mechanics 451, or Civil Engineering 379, or consent of instructor. 1 unit.
479. **Earthquake Engineering.** Study of the effects of earthquakes on constructed works and of the design of structures to resist earthquake motions; earthquake ground motions and mechanisms; response of structures to earthquake motion; behavior of materials, elements, assemblages and structures subjected to earthquake motion; principles of earthquake resistant design; and special topics. Prerequisite: Civil Engineering 374. 1 unit.
480. **Earth Pressures and Retaining Structures.** Classical and modern earth pressure theories and their experimental justification; pressures and bases for design of retaining walls, bracing of open cuts, anchored bulkheads, cofferdams, tunnels, and culverts. Prerequisite: Credit or concurrent registration in Civil Engineering 384. 1 unit.
481. **Earth Dams and Related Problems.** Fundamentals of problems of slope stability; seepage in composite sections and anisotropic materials; methods of stability analysis; mechanism of failure of natural and artificial slopes; compaction; and field observations. Prerequisite: Credit or concurrent registration in Civil Engineering 384. 1 unit.

482. **Advanced Soil Mechanics, I.** Theoretical and experimental studies in soil mechanics; stress distribution in homogeneous and stratified soils; theory of consolidation for multi-directional flow and time-dependent loading; numerical methods; secondary consolidation; settlement analysis; and experimental measurements. Prerequisite: Civil Engineering 383. 1 unit.
483. **Advanced Soil Mechanics, II.** Theoretical and experimental studies in soil mechanics; shearing properties of saturated soils; physical properties of partially saturated soils; physicochemical properties of clays; and laboratory direct shear and triaxial shear testing. Prerequisite: Civil Engineering 383. 1 unit.
484. **Foundation Engineering.** Critical study of case histories of projects in foundation engineering; current procedure for design and construction of foundations, embankments, and waterfront structures. Prerequisite: Civil Engineering 384. 1 unit.
485. **Soil Engineering for Transportation Facilities.** Systems of soil classification; application of statistical methods to soil engineering; relation of mineralogy to engineering properties; soil water migration and volume change; soil structure and stabilization by compaction; soil freezing and pavement behavior; behavior under repeated loading; and stability of base embankments. Prerequisite: Civil Engineering 383 or equivalent. 1 unit.
486. **Rock Mechanics, I.** Physical properties and classification of intact rock, theories of rock failure, state of stress in the earth's crust, stresses and deformations around underground openings assuming elastic, plastic, and time-dependent behavior; effect of geologic discontinuities on rock strength; and introduction to stability analyses in rock. Prerequisite: Civil Engineering 383; Geology 450 or equivalent; Theoretical and Applied Mechanics 321 or equivalent; or consent of instructor. 1 unit.
487. **Rock Mechanics, II.** Application of rock mechanics to engineering problems; shear strength of rock masses; dynamic and static stability of rock slopes; deformability of rock masses; design of pressure tunnel linings and dam foundations; controlled blasting and blasting vibrations; tunnel support; machine tunneling; design and construction of large underground openings; and field instrumentation. Prerequisite: Civil Engineering 486 or consent of instructor. 1 unit.
494. **Municipal Administration and Engineering.** Legal authority of municipalities, and forms of municipal government; municipal functions, organization, and management; city finance; engineering functions of city government; city planning and zoning; building codes and inspection; street lighting; public utilities; city cleaning; and recreational development. Prerequisite: Bachelor of Science in civil engineering or consent of instructor. 1 unit.
495. **Civil and Environmental Engineering Seminar.** Discussion of current topics in civil and environmental engineering and related fields by staff, students, and visiting lecturers. 0 to ¼ unit. Course may be repeated.
497. **Special Problems.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by his adviser and the staff member who will supervise the investigation. Prerequisite: Consent of instructor. 0 to 4 units.
499. **Thesis Research.** 0 to 4 units.

CLASSICAL ARCHAEOLOGY

(See Classics under Humanities, School of)

CLASSICAL CIVILIZATION

(See Classics under Humanities, School of)

COMMUNICATIONS

Chairperson of Committee on Graduate Study: Professor J. W. Carey

Office: 222 Armory, Champaign

217. **History of Communications.** Same as Journalism 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; and communications in the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
218. **Communications and Public Opinion.** Same as Journalism 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
220. **Processes and Systems of Communications.** Same as Journalism 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communication. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
231. **Mass Communications in a Democratic Society.** Same as Journalism 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
241. **Law and Communications.** Same as Journalism 241. Historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Journalism 251 and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
307. **The Art of the Screen: Narration.** Same as Speech Communication 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Speech Communication 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Communications 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or $\frac{1}{2}$ or 1 unit.
319. **Russian and East European Cinema.** Same as Slavic and Speech Communication 319. Artistic, literary, and social aspects of cinematic history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures concentrators. 3 hours or $\frac{3}{4}$ unit.

325. **Introduction to Psycholinguistics.** Same as Linguistics 325. Introductory survey of psychological and linguistic approaches to the study of communication. Credit is not given for both Psychology 325 and Communications 325. Prerequisite: Credit or concurrent registration in Linguistics 300. 3 hours or 1 unit.
335. **Interpersonal Communication Processes.** Same as Speech Communication 335. Study of the major processes involved in an individual's everyday life; emphasis on the development of interpersonal competency and orientations, social perception, interpersonal sentiment and hostility, trust, and the social context as factors influencing the understanding and evaluation of interpersonal messages. 3 hours, or $\frac{1}{2}$ or 1 unit.
352. **Attitude Theory and Change.** Same as Psychology 352 and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201, or a comparable introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Language, Culture, and Society.** Same as Anthropology 370 and Linguistics 370. Examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230, one course in communications or linguistics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
377. **International Communications.** Same as Political Science 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; and government-industry relations in communications. 3 hours or 1 unit.
414. **Seminar on Social Interaction.** Same as Sociology 414. Analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas; presentation of problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
417. **Contemporary Viewpoints in Speech Communication Theory.** Same as Speech Communication 417. A readings seminar comparing the principal approaches to communication and rhetorical theory in the twentieth century along with a consideration of their philosophical assumptions. 1 unit.
420. **Seminar in Semantics.** Same as Philosophy 420. Intensive study of important contemporary contributions in semantics, analytic philosophy, and the philosophy of language. Prerequisite: Graduate standing in philosophy or equivalent. 1 unit. May be repeated.
424. **Developmental Psycholinguistics.** Same as Linguistics 424 and Psychology 424. Advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Linguistics 425 and Psychology 425. Critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic, information-theory, and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Linguistics 426 and Psychology 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course are expected to plan, execute, and report an original piece of research in this area. Prerequisite: Communications 425; consent of instructor. $\frac{1}{2}$ or 1 unit.
432. **Books and Libraries Since the Renaissance.** Same as Library Science 432. Study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
437. **The Analysis of Interpersonal Interaction.** Same as Speech Communication 437. Exploration of theory, methodology, and empirical findings of descriptive and experimen-

tal approaches to the analysis of verbal and nonverbal interaction processes in both laboratory and naturalistic settings. Prerequisite: Communications 335 or consent of instructor. 1 unit.

444. **Seminar in Public Opinion.** Same as Sociology 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; and mass media and public opinion. 1 unit.
456. **Attitude Measurement and Behavioral Prediction.** Same as Psychology 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction; emphasis on the attitude concept and the validity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.
462. **Seminar in Radio and Television.** Same as Radio and Television 462. Study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
463. **World Broadcasting.** Same as Radio and Television 463. Study of the broadcast systems used by the nations of the world; alternative and mixed systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other countries; implications of such new developments as satellites; and mass and nonmass uses. Prerequisite: Consent of instructor. 1 unit.
468. **The Political Economy of Communications.** Same as Journalism 468. Analysis of the structure, policy, and behavior of such media of communications as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film, with special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
470. **Communications and Popular Culture.** Same as Journalism 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
471. **Proseminar in Communications, I.** Same as Journalism 471. General discussion of the mass media of communications, their role as social institutions, and their control and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
472. **Proseminar in Communications, II.** Same as Journalism 472. General discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
473. **History and Theory of Freedom of the Press.** Same as Journalism 473. Development of the Anglo-American press system and the idea of freedom of the press; contemporary mass media and their implications for freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
474. **Communications Systems.** Same as Journalism 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. Prerequisite: Consent of College of Communications. 1 unit.
481. **Economic and Social Aspects of Advertising.** Same as Advertising 481. Examination of advertising as an institution; the economic, social, and legal aspects of advertising with focus on current problems. Graduate credit is not given for both Communications 481 and Advertising 393. Prerequisite: Consent of department. 1 unit.
482. **Research Methods in Advertising and Communications.** Same as Advertising 482. Treatment of basic research concepts and procedures in the social sciences with emphasis on advertising and communications, and an examination of both nonquantitative and quantitative methods. Prerequisite: A basic course in statistical methods; consent of department. 1 unit.
485. **Advertising Planning and Decision Making.** Same as Advertising 485. Examination of the theoretical foundations of decision theory as related to planning and decision mak-

ing in advertising; use of decision models in the development of strategies and tactics. Prerequisite: Consent of department. 1 unit.

- 490. **Special Topics in Communications.** Prerequisite: Consent of chairperson of committee on graduate study in communications. ½ to 2 units.
- 492. **Research Methods in Communications.** Same as Journalism 492. Introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication, with emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
- 499. **Thesis Research.** Prerequisite: Consent of chairperson of committee on graduate study in communications, and of thesis supervisor. 0 to 4 units. Students may reregister for a total of 8 units.

COMPARATIVE LITERATURE

(See Humanities, School of)

COMPUTER SCIENCE

Head of Department: Professor J. N. Snyder

Department Office: 252 Digital Computer Laboratory, Urbana

- 101. **Introduction to Computers for Application to Engineering and Physical Science.** Introduction to machine organization, problem formulation, automatic programming, numerical analysis, machine language programming, and applications of computers; use of the computing facilities of the department for solving problems. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. 3 hours.
- 102. **Introduction to Computers and Their Application to Architecture.** Introduction to computer programming for students of architecture; higher-level programming languages and application programs of special use in architecture. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. 3 hours.
- 103. **Introduction to Computers and Their Application to Social and Behavioral Science.** Introduction to computer programming for students with an interest in behavioral and social science computation; instruction in programming languages (FORTRAN and PL/I) with an emphasis on applications from statistical and data manipulative procedures. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. Prerequisite: Sophomore standing; one year of college mathematics or statistics. 3 hours.
- 105. **Introduction to Computers and Their Application to Business and Commerce.** Introduction to computer fundamentals, higher language programming, and the use of the computer for the solution of business problems. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. 3 hours.
- 106. **Computers and Their Applications.** Introduction to the general principles and concepts of computer operation and programming, and their applications to different areas; students use the PLATO Computer-based Education System; primarily for non-technically oriented students. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. A 100-level computer science

- course other than 106 is recommended if further computer science courses are to be taken. 3 hours.
107. **Introduction to Computers for Secondary School Teachers of Mathematics.** Introduction to principles of digital computer operation, programming in machine and higher level languages, and applications; intended to make teachers aware of the possibilities that computers have in education in the mathematical sciences; and use of computers to solve problems. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107 or 121. Prerequisite: One year of college calculus. 3 hours.
121. **Introduction to Computer Programming.** The beginning course for students in the mathematics and computer science curriculum, and for other interested students; covers topics in digital computer organization, problem formulation, programming languages, and the solution of numerical and nonnumerical problems. Students write several programs to find solutions to problems using digital computers. Students may receive credit for only one of the following: Computer Science 101, 102, 103, 105, 106, 107, or 121. 4 hours.
196. **Honors Course in Computer Science.** This course is offered for honors credit in conjunction with other 100-level computer science courses, in which concurrent registration is required. Enrollment is strictly limited to beginning students with superior talents in computer science. A special examination may be required for admission to this course. Prerequisite: Concurrent registration in another 100-level computer science course (see *Timetable*); consent of instructor. 1 hour.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
221. **Program and Data Structures.** Block structured program concepts; structured design of algorithms and data; machine organization; linkers and loaders; and introduction to assembler organization. Prerequisite: Computer Science 121 or other computer science 100-level course, or consent of instructor. 3 hours.
257. **Introduction to Numerical Analysis.** Same as Mathematics 257. Introduction to the principles and techniques of numerical mathematics for students in the physical sciences; includes topics in roundoff-error analysis, approximation of functions, derivatives and integrals, and numerical solution of nonlinear equations, ordinary differential equations, and systems of linear equations. The computer is used extensively and a term project may be assigned. Prerequisite: A basic computer science 100-level programming course, one year of calculus, or consent of instructor. 3 hours. Students may not receive credit for both Computer Science/Mathematics 257 and Computer Science 350.
264. **Introduction to the Structure and Logic of Digital Computers.** Introduction to the internal structure of digital computers; design of gates, flipflops, registers, and memories to perform operations on numerical and other data represented in binary form; and presentation in terms of logic devices (black boxes), not electrical circuits. Students may not receive credit for both Computer Science 264 and 360. Prerequisite: Computer Science 121 or equivalent is required; credit or concurrent registration in Computer Science 221 recommended. 3 hours.
265. **Logic Design Laboratory with Integrated Circuits.** A digital design laboratory employing the department's EXCEL integrated circuit modular logic kits; emphasizes designing with logic blocks (not the design of their internal circuits), the theory of which is treated in Computer Science 264. Experiments with combinational and sequential networks and simple digital systems culminate in a term project. Prerequisite: Credit or concurrent registration in Computer Science 264, credit in Electrical Engineering 290, or consent of instructor. 2 hours.
273. **Introduction to Theory of Computation.** Introduction to the various aspects of the theory of computation, including the necessary background in graph theory, combinatorics, and probability theory; also includes algorithmic procedures, theoretical limitations of computing machines, analysis of algorithms, and correctness and efficiency of algo-

- rhythms. Prerequisite: Computer Science 121 or equivalent, or consent of instructor. 3 hours.
281. **Introduction to Computer Circuitry.** Introduction to the operation of semiconductor devices and circuits used in information processing; lecture and demonstration. Prerequisite: Physics 102 or 107, or equivalent. 3 hours.
290. **Individual Study.** Prerequisite: Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 1 or 2 hours.
296. **Honors Course in Computer Science.** Group projects for honors work in computer science. Sections of this course are offered in conjunction with other 200-level computer science courses, in which concurrent registration is required. A special examination may be required for admission to this course. Prerequisite: Concurrent registration in another 200-level computer science course (see *Timetable*); consent of instructor. 1 hour.
297. **Special Topics in Computer Science.** A lecture course in topics of current interest. See *Timetable* for current topics. Prerequisite: Consent of instructor. 2 to 4 hours.
300. **Advanced Computer Programming.** Advanced features of programming languages; input/output disks and tapes; plotted output; and use of operating systems and job control languages. This course is intended primarily for students who are not majoring in computer science. Students majoring in computer science may not receive graduate credit for Computer Science 300. Students may not receive credit for both Computer Science 300 and 221. Prerequisite: Computer Science 100-level programming course or Computer Science 400, or consent of instructor. 3 hours or 1 unit.
311. **Information Systems.** Organization of automatic systems for the recognition and retrieval of information; data base description, and pattern recognition; computer-aided diagnosis; and an introduction to formal cognitive systems (specifically to artificial intelligence and heuristic programming). Prerequisite: Computer Science 321. 3 hours or 1 unit.
313. **Combinatorial Mathematics.** Same as Mathematics 313. Permutations and combinations; generating functions, recurrence relations; inclusion and exclusion; Polyá's theory of counting; and block designs. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
317. **Computer-Assisted Instruction.** Same as Secondary Education 317. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons; and treatment of instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Any Computer Science 100-level programming course, or consent of instructor. 4 hours or 1 unit.
318. **Computer Graphics.** Software, hardware, and mathematical tools for the representation, manipulation, and display of topological and two- and three-dimensional objects; applications of these tools to specific problems. Prerequisite: Computer Science 221, Computer Science 264, or Electrical Engineering 290, and consent of instructor. 3 hours or 1 unit.
321. **Information Structures.** Lists, trees, and graphs; applications to string processing and pattern matching; storage allocation; and collection of unused memory space. Prerequisite: Computer Science 221. 3 hours or 1 unit.
323. **Systems Programming.** Discussion of the organization and structure of operating systems for various modes of computer use from simple batch systems to time-sharing/multiprocessing systems. Prerequisite: Computer Science 221. 3 hours or 1 unit.
325. **Programming Language Principles.** An introduction to the structure of programming languages. Formal specification of syntax and semantics; structure of algorithmic, list processing, string manipulation, data description, and simulation languages: basic data types, operations, statement types, and program structure; macro languages and their implementation; and run-time representation of programs and data. Prerequisite: Computer Science 221 or consent of instructor. 3 hours or 1 unit.
326. **Compiler Construction.** Compiler structure; lexical analysis, syntax analysis, grammars, description of programming languages, automatically constructed recognizers,

- and error recovery; and semantic analysis, semantic languages, semantic processes, intermediate language, optimization techniques, and extendible compilers. Prerequisite: Computer Science 325 or consent of instructor. 3 hours or 1 unit.
333. **Computer System Organization.** Computer system analysis and design; organizational dependence on computations to be performed; and speed and cost of parts and overall machines. Prerequisite: Computer Science 221. 3 hours or 1 unit.
337. **Control Structure of Computers.** Same as Electrical Engineering 337. Asynchronous, synchronous, and microprogrammed control structures in the framework of computer architecture; interlocking of autonomous subcontrols; and case studies in typical control features: instruction look-ahead, multiprocessing interrupt, and input/output. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 391 or Computer Science 221, or consent of instructor. 3 hours or 1 unit.
346. **Pattern Recognition and Machine Learning.** Organized review of basic theoretical concepts and methods of machine learning and recognition; decision space and linguistic and relational representation of objects; statistical and deterministic recognition algorithms; various types of learning, including adaptive, procedural, and inductive; selected applications; and medical consulting, determination of cost-optimal classification rules, inferential information systems, and computer vision. Prerequisite: Computer Science 264, or equivalent, and Computer Science 321; or consent of instructor. 3 hours or 1 unit.
350. **Numerical Algorithms for Applications.** Numerical analysis for students in applications areas; topics include analysis of roundoff errors, solution of nonlinear equations, numerical integration, numerical linear algebra, approximation of functions, and ordinary differential equations; additional topics may be selected. Emphasizes concepts and avoids mathematical formalism; discusses necessary programming techniques; and employs standard FORTRAN programs for numerical methods. Prerequisite: One year of calculus; a Computer Science 100-level programming course; and Mathematics 315 or equivalent. 3 hours or 1 unit. Students may not receive credit for both Computer Science 350 and Computer Science/ Mathematics 257. Students in computer science may not receive graduate credit for Computer Science 350.
358. **Numerical Analysis: Linear Problems.** Same as Mathematics 358. Numerical methods for linear algebra and eigenvalue problems with some applications to linear boundary value problems for differential equations. Prerequisite: Computer Science/Mathematics 257, Mathematics 315 or 318, and Mathematics 343; or consent of instructor. 3 hours or 1 unit.
359. **Numerical Analysis: Nonlinear Problems.** Same as Mathematics 359. The development and analysis of algorithms for polynomial and spline interpolation; least squares and Chebyshev approximation; interpolatory and Gaussian quadrature; solution of systems of nonlinear equations; and the initial-value problem in ordinary differential equations. Prerequisite: Computer Science/Mathematics 257 and Mathematics 343, or consent of instructor. 3 hours or 1 unit.
360. **Scientific Applications of Minicomputers.** Structure and programming of a minicomputer; operation and use of minicomputer peripherals; and basic digital design techniques using commercially available integrated circuits, with emphasis on the use of minicomputers in scientific experiments. Students majoring in computer science may not receive graduate credit for Computer Science 360. Students may not receive credit for both Computer Science 360 and 264. Prerequisite: Any introductory computer science course, or consent of instructor. 4 hours or 1 unit.
363. **Integrated Circuit Logic Design.** IC fabrication techniques; survey of different IC logic families; logic design procedures for each IC logic family; design of masks; logic design of digital networks with IC packages; use of ROMs as substitute for gates; computer-aided design; and comparison of different implementation approaches based on different IC logic families, from the viewpoints of economy, performance, and design time. Prerequisite: Mathematics/ Computer Science/Electrical Engineering 391 and

- either Computer Science 281 or Electrical Engineering 342, or consent of instructor. 3 hours or 1 unit.
364. **Introduction to Computer Arithmetic.** Same as Electrical Engineering 364. Review of binary number representations, logical design of adders and arithmetic units, and simple multiplication and division methods; multiplier recoding; redundant division methods; design of carry-save adders and signed-digit arithmetic units; and case studies of high-speed arithmetic units. Prerequisite: Computer Science 264. 3 hours or 1 unit.
365. **Digital Computer Methods for Statistical Data Processing.** Same as Agronomy 365. Study of methods for efficient utilization of high-speed equipment in the processing of statistical data; emphasis on principles of application of computing equipment to the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: A course in statistics or statistical methods, or equivalent, and any Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
373. **Combinatorial Computing.** Same as Mathematics 373. Computational aspects of algorithms for solving combinatorial problems; counting and enumeration, sorting, searching, and computational problems in graph theory and algebra. Prerequisite: Mathematics 315 or equivalent, and Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
375. **Automata and Formal Languages, I.** Same as Mathematics 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; and Post's correspondence problem and its application to context-free languages. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
376. **Automata and Formal Languages, II.** Continuation of topics in Computer Science 375. Context-sensitive languages and linear bounded automata; operations on languages, closure properties, and abstract families of languages; miscellaneous unsolvable problems; time- and tape-bounded Turing machines; and other topics chosen by the instructor. Prerequisite: Computer Science 375. 3 hours or 1 unit.
378. **Computer Application to Problems in Mathematics.** Same as Mathematics 378. Discussion of many problems which can be formulated mathematically and lend themselves to computer solution. Problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; and game playing and decision problems. Prerequisite: Junior standing; Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
381. **Introduction to Computer Memories and I/O.** Same as Electrical Engineering 381. Introduction to memories, input/output devices, and optical processors; lecture and demonstration. Prerequisite: Computer Science 281, Electrical Engineering 340, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Linear Programming.** Same as Mathematics 383. Systems of linear inequalities, the standard canonical and general linear problems, and simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
384. **Information and Signal Processing by Computing Devices.** Same as Electrical Engineering 384. Operation and theory of computing devices for signal and information processing; analog, digital, and stochastic information representation and processing; and conversion of information representation from one type to another. Prerequisite: Computer Science 264 and 281, or Electrical Engineering 290 and 340, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
385. **Semiconductor Computer Devices.** Same as Electrical Engineering 385. The theory of bipolar junction transistors and the fabrication of monolithic integrated logic circuits; unipolar field effect device properties, theory, fabrication, and application to logic and memories. Prerequisite: Computer Science 281, Electrical Engineering 340, or equivalent. 3 hours or 1 unit.

386. **Computer Displays and Peripherals.** Same as Electrical Engineering 396. Theory and operation of computer displays and peripheral devices; human and machine aspects; and available techniques and devices. Prerequisite: Computer Science 381 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
389. **Digital Computer Circuit Design.** Same as Electrical Engineering 389. Design of switching circuits and systems, taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data handling links; and consideration of component tolerance, circuit reliability, and cost factors. Prerequisite: Computer Science 264 or Electrical Engineering 290 and either Computer Science 281 or Electrical Engineering 340. 3 hours or 1 unit.
391. **Switching Theory.** Same as Electrical Engineering 391 and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Computer Science 264, Electrical Engineering 290, or Mathematics 319, or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Mathematics 392 and Electrical Engineering 392. Synchronous machines; state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines; and hazards and interacting machines. Prerequisite: Mathematics 319 and Computer Science/Electrical Engineering/Mathematics 391, or consent of instructor. 3 hours or 1 unit.
397. **Special Topics in Computer Science.** Lectures in topics of current interest. See *Timetable* for current topics. Prerequisite: Consent of instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
400. **Introduction to Automatic Digital Computing for Graduate Students.** Beginning course covering the programming of digital computers using procedure-oriented language. No graduate credit allowed. 1 hour.
414. **Engineering Applications of Linear Graphs.** Same as Electrical Engineering 414. Elementary theory of linear graphs and Euler graphs; incidence, cut-set, and circuit matrices and their properties; realizability of cut-set, circuit, and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; and communication networks. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318. 1 unit.
425. **Topics in Compiler Construction.** Advanced topics in compiler construction, including incremental and interactive compiling, error correction, code optimization, models of code generators, etc. Prerequisite: Computer Science 321 and 326, or consent of instructor. 1 unit.
433. **Theory of High-Speed Parallel Computation.** Same as Electrical Engineering 433. Theoretical aspects of parallel and pipeline computation; time and processor bounds on classes of computations; data alignment network speed and cost bounds; conflict-free access memories; and overall computer system ideas. Prerequisite: Computer Science 333 or equivalent. 1 unit.
441. **Computer Systems Analysis.** Development of analytical tools for modeling and analysis of real time computer systems; techniques include queueing theory, scheduling theory, and operations research methods. Prerequisite: Mathematics 361 or 363, or equivalent. 1 unit.
443. **Linear and Integer Programming.** Discussion of mathematical programming algorithms which are widely used along with their software packages and computational efficiencies; a self-contained discussion of linear programming; and discussion of the various algorithms of integer programming. Prerequisite: Mathematics 315 or equivalent. 1 unit.
444. **Introduction to Artificial Intelligence.** Same as Electrical Engineering 444. Introduction to basic concepts in artificial intelligence with emphasis on computer understanding of natural language concepts; data structure and list processing; linguistic analysis including both syntactic and semantic processing; automatic logic deduction and theo-

- rem proving; and survey of applications to systems including question answering, information retrieval, and problem solving. Prerequisite: Consent of instructor. 1 unit.
445. **Systems Modeling and Simulation.** Same as Business Administration 475. Theory and techniques of simulation and gaming; simulation languages such as GPSS, DYNAMO, and SIMSCRIPT. Applications: investigation, control, and design of various systems (inventory, production scheduling, computer, marketing, and others). Prerequisite: Computer Science 105 Mathematics 363, or Business Administration 374, or equivalent, or consent of instructor. 1 unit.
456. **Coding Theory.** Same as Electrical Engineering 456. General discussion on coding theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; and applications to computers and data transmission systems. Prerequisite: Mathematics 317 or equivalent, or consent of instructor. 1 unit.
457. **Numerical Solution of Ordinary Differential Equations.** Same as Mathematics 457. Derivation and rigorous analysis of one-step, multistep, and extrapolation methods, variable stepsize, error estimation, stiff equations, and boundary value problems. Prerequisite: Computer Science/Mathematics 359 and Mathematics 315 or 318, or consent of instructor. 1 unit.
458. **Topics in Numerical Analysis.** Same as Mathematics 458. Prerequisite: Consent of instructor. 1 unit. May be repeated.
463. **Information Theory.** Same as Electrical Engineering 463 and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361 or equivalent. 1 unit.
464. **Topics in Digital Computer Arithmetic.** Same as Electrical Engineering 464. Topics selected from the advanced theory of digital computer arithmetic, including division methods, use of redundancy, and implications of the use of number representations, such as continued products and continued fractions. Prerequisite: Computer Science/Electrical Engineering 364. 1 unit.
465. **Topics in Automata Theory.** Same as Electrical Engineering 465 and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 392, or consent of instructor. 1 unit.
469. **Introduction to Coherent Optics and Holography.** Same as Electrical Engineering 469. The diffraction transformation of aperture distributions between parallel planes and the imaging and Fourier-transforming properties of lenses; the theory of coherence; the principles of optical and digital holography; and devices and systems for optical data processing. 0 or 1 unit.
473. **Topics in Analysis of Algorithms.** Theoretical analysis of various algorithms; topics include sorting, searching, selection, polynomial evaluation, matrix multiplication, and multiplication of real numbers. Prerequisite: Computer Science or Mathematics 373 or equivalent, or consent of instructor. 3 hours or 1 unit.
475. **Topics in Combinatorics.** Same as Mathematics 475. Selected topics from graph theory, algebraic coding theory, enumerative analysis, combinatorial design, and discrete optimization; includes other topics of current research interest, such as Ramsey's Theorem, Sperner's Theorem, Dilworth's Theorem, and the theory of matroids. Prerequisite: Computer Science 273, Computer Science/Mathematics 313, or consent of instructor. 1 unit.
485. **Topics in Computer Hardware.** Same as Electrical Engineering 485. Advanced features of computer hardware; topics vary, but typically are chosen from: memories, optical data processing and storage, device modeling and computer-aided circuit design, and stochastic representation and processing of information. Prerequisite: Consent of instructor. 1 unit.
487. **Theory of Approximation.** Same as Mathematics 487. General approximation theory in normed linear spaces with primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Che-

byshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants as approximants; and use of approximations in computing. Prerequisite: Mathematics 318 or 348, or consent of instructor. 1 unit.

- 490. **Individual Study.** Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
- 491. **Seminar in Computer Science.** Seminar on topics of current interest. See *Timetable* for current topics. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
- 497. **Special Topics in Computer Science.** Lecture course in topics of current interest. See *Timetable* for current topics. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
- 499. **Thesis Research.** Section A, for master's degree candidates; Section B, for doctoral degree candidates. Prerequisite: Consent of instructor. 0 to 4 units.

COPTIC

(See Classics under Humanities, School of)

CZECH

(See Slavic Languages and Literatures under Humanities, School of)

DAIRY SCIENCE

Head of Department: Professor K. E. Harshbarger

Department Office: 315 Animal Sciences Laboratory, Urbana

- 100. **Introduction to Dairy Production.** Survey of industry; breeds of cattle; and selection, feeding, and management of herds. Lecture, quiz, and laboratory. 3 hours.
- 110. **Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Horticulture 110. Principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111, or Botany 100 or 101. 3 hours.
- 201. **Livestock Management.** Same as Animal Science 201. Principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Dairy science and animal science majors do not receive credit for this course. Prerequisite: Dairy Science 221 or Animal Science 325. 5 hours.
- 204. **Dairy Cattle Evaluation.** Relation of functional conformation, records, ancestry, progeny tests, age, environment, and individual traits as criteria which affect merit for milk production, breeding stock, and breeder acceptance. Prerequisite: Dairy Science 100 or consent of instructor. 3 hours.
- 205. **Dairy Cattle Management.** Applied aspects of feeding, breeding, care, and management as they relate to the effective operation of a dairy farm enterprise. 3 hours.
- 221. **Animal Nutrition.** Same as Animal Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Dairy Science 221 and Animal Science 325. Prerequisite: Chemistry 102 or equivalent. 4 hours.
- 230. **Comparative Physiology of Reproduction, Lactation, and Growth.** Same as Animal Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: One course in chemistry. 3 hours.

300. **Special Problems.** Supervised research on any phase of dairy science, including biochemistry, genetics, management, microbiology, nutrition, and physiology. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in dairy science subject to approval of the instructor. Prerequisite: Not open to students on probation; written consent of instructor and authorized departmental approval are required prior to advance enrollment and registration. 1 to 5 hours, or $\frac{1}{2}$ to 1 unit.
305. **Genetics and Animal Improvement.** Same as Animal Science 305. Principles of heredity and their application to the problems of animal improvement. Prerequisite: Dairy Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit).
308. **Physiology of Lactation.** The anatomy and endocrinology of mammary development; the environmental, endocrinological, and biochemical factors which affect the yield and composition of milk. Prerequisite: Chemistry 102 or 103, or equivalent with consent of instructor. 4 hours or 1 unit.
316. **Population Genetics.** Same as Biology 316. Mathematical theory of the genetics of populations: estimation of gene frequency, Hardy-Weinberg principle, systems of mating, relationship between relatives, and forces that change gene frequency; applications to man, animals, and plants. Students desiring 4 hours or 1 unit credit do additional work in some area of population genetics. Prerequisite: Dairy Science 110, or Biology 210 and college algebra, or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
320. **Nutrition and Digestive Physiology of Ruminants.** Same as Animal Science 320. Physiology and microbiology of digestion in the ruminant, and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Dairy Science 221. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit).
330. **Reproduction and Artificial Insemination of Farm Animals.** Same as Animal Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Dairy Science 100 or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, 2 hours or $\frac{1}{2}$ unit).
334. **Marketing of Dairy Products.** Same as Agricultural Economics 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, mark-up laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; and expanding markets for dairy products. Inspection trip; see *Timetable* for approximate cost. Prerequisite: Agricultural Economics 230, an elementary marketing course, or 12 hours of dairy science or dairy technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
350. **World Animal Agriculture.** Same as Animal Science 350. Surveys the role of animal agriculture in various geographic and cultural areas of the world; emphasizes animal, environmental, and resource relationships in the provision of food, fiber, and power for human needs. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
402. **The Microbiology and Physiology of Ruminant Nutrition.** Physiological and microbiological aspects of ruminant digestion and their influence on the metabolism of the extraruminal tissues; interpretation of nutritive requirements in terms of rumen microbial activities; and evaluation of research techniques. Prerequisite: Biochemistry 350 or equivalent. $\frac{3}{4}$ unit.
408. **Physiology and Biochemistry of Milk Secretion.** Biological structure and function of lactating mammary tissue, ruminant and nonruminant; emphasizes mammary secretory cell biochemical pathways, ultrastructure, and transport mechanisms pertaining to

- milk synthesis. Prerequisite: Dairy Science 308 and Biochemistry 350, or equivalent; or consent of instructor. $\frac{3}{4}$ unit.
410. **Current Topics in Nutritional Research.** Same as Food Science and Nutritional Sciences 410. Discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. $\frac{3}{4}$ unit.
411. **Chemistry of Nutritional Processes.** Same as Food Science and Nutritional Sciences 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. 1 unit.
412. **Advanced Endocrinology.** Same as Animal Science, Physiology, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312 or Zoology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 2 units.
416. **Quantitative Genetics.** Same as Biology 416. The mathematical theory of the genetics of quantitative traits: properties of random-mating populations; estimation of repeatability, heritability, and genetic correlation; genetic results of selection; aids to selection; correlated response; selection for more than one trait; and applications to animals and plants. Prerequisite: Dairy Science 316 and 340, or consent of instructor. 1 unit.
430. **Physiology of Mammalian Germ Cells.** Literature and laboratory course covering the recent theories and developments on the formation, transportation, and livability of spermatozoa and ova within the body, and their metabolism and preservation *in vitro*. Prerequisite: Dairy Science 330, Animal Science 406, and Biochemistry 350, or consent of instructor. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Dairy Science 340 or equivalent. $\frac{3}{4}$ unit.
481. **Animal Biochemical Laboratory Techniques.** Same as Animal Science 481. Theory and application of biochemical laboratory techniques to research in the animal-oriented biological sciences; isolation, characterization, and analysis of biological compounds including enzymes, metabolic intermediates, and cellular components; and determination of metabolic pathways and processes. Prerequisite: Biochemistry 350 and 355; consent of instructor. 1 unit.
490. **Dairy Science Seminar.** Discussions of current research and literature. Registration for 0 or $\frac{1}{2}$ unit every semester is required for graduate students majoring in dairy science. 0 or $\frac{1}{2}$ unit.
493. **Special Problems.** Individual investigation in any phase of dairy science. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.

DANCE

Head of Department: Professor O. J. Kostock

Department Office: 4-305 Krannert Center for the Performing Arts, Urbana

101. **Beginning Modern Dance.** Introduction to basic dance technique and movement improvisation; the study of motion as an art, group relationships in improvisation, and discussion of choreographic ideas. For nondance majors. 1 hour. May be repeated for a maximum of 4 hours.
102. **Intermediate Modern Dance.** Intermediate dance technique and improvisation. For

- nondance majors. Prerequisite: Dance 101 or consent of instructor. 1 hour. May be repeated for a maximum of 4 hours.
150. **Orientation to Dance as Art and Education.** Orientation to the field of dance and its place in education; general dance history, history of modern dance movement, philosophy of dance, and discussion of theories and problems involved in dance education. Students in the teaching of dance curriculum are required to enroll in Secondary Education 101, dance section. 2 hours.
160. **Modern Technique, I.** Beginning modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
162. **Improvisation, I.** Experience in selective and basic processes of movement involvement, both individual and group; attention to organic and economical use of movement, the dynamics and quality of which are necessary to the activity being performed. 1 hour.
163. **Improvisation, II.** Continuation of Dance 162, with emphasis on expanding bodily activity into various existing or created performing environments (composed of sound, lights, and costumes); attention to expanding audience-performer relationships, to audio-visual effects, and to collaborative work with musicians, designers, and technicians in these related areas. Prerequisite: Dance 162 or consent of instructor. 1 hour.
164. **Beginning Composition.** Theory and practice in principles of dance composition; emphasis on solo creative work using various approaches to composition. Prerequisite: Dance 163 or consent of instructor. 2 hours.
166. **Ballet, I.** 0 or 1 hour. May be repeated once for credit.
168. **Music Theory and Practice for Dance, I.** Analysis and organization of movement and music in terms of its rhythmic components, time, and force. 2 hours.
169. **Music Theory and Practice for Dance, II.** Progressive continuation of Dance 168, with emphasis on music theory, rhythmic awareness, and interpretation of melodic material; theory and practice in accompanying dance classes; and familiarity with existing music for the dance. Prerequisite: Dance 168 or consent of instructor. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
243. **Creative Dance for Children.** Theory and method of teaching dance to children; supervised practical teaching experience with first-through eighth-grade children. Prerequisite: Dance 164 or consent of instructor. 3 hours.
244. **Teaching of Dance for Adolescents and Adults.** Theory and practice in methods of teaching dance at the high school level, including lesson planning and curriculum construction. Students in the teaching of dance curriculum are required to enroll in Secondary Education 241. Prerequisite: Dance 243 or consent of instructor. 3 hours.
245. **Dance in the Elementary School.** Theory and practice in methods of teaching dance in the elementary school; practical experience in observation and teaching within an elementary school system. Prerequisite: Dance 243. 2 hours.
260. **Modern Technique, II.** Intermediate modern dance technique. Prerequisite: Two semesters of Dance 160 or equivalent, and consent of instructor. 2 or 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.
264. **Intermediate Composition.** Experience in choreographing a minimum of one solo and two group works utilizing various approaches to choreographic form. Prerequisite: Dance 164 or consent of instructor. 2 hours.
266. **Ballet, II.** Prerequisite: Two semesters of Dance 166 or equivalent and consent of instructor. 0 or 1 hour. May be repeated once for credit.
335. **Dance Repertory Workshop.** Experience in learning, rehearsing, and perfecting concert dance pieces under the direction of experienced choreographers. Prerequisite: Enrollment in advanced technique course; consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated for a maximum of 12 hours or 2 units.
340. **History of Dance, I.** Survey of dance from its beginnings in primitive societies through the nineteenth century. Prerequisite: Consent of instructor. 3 hours or 1 unit.
341. **History of Dance, II.** Survey of the development of dance in the twentieth century. Prerequisite: Dance 340; consent of instructor. 3 hours or 1 unit.

- 345. **Dance Production Workshop.** Experience in choreography and production of group compositions with special emphasis on staging, lighting, and costuming. Prerequisite: Dance 264 or consent of instructor. 3 hours or 1 unit.
- 346. **Theory and Philosophy of Dance.** Study of the relationship of aesthetic principles and dance theory to a philosophy of dance in education and of dance as a performing art. Prerequisite: Dance 340 or consent of instructor. 3 hours or 1 unit.
- 351. **Special Problems.** Special projects in research or creative investigation taught on an individual basis. Prerequisite: Junior standing; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated for a maximum of 8 hours or 2 units.
- 353. **Improvisation, III.** Advanced improvisational techniques and forms; theory and practice in advanced concepts of creative improvisational human movement as public art form. Prerequisite: Dance 264 or equivalent. 1 hour or $\frac{1}{4}$ unit.
- 360. **Modern Technique, III.** Advanced modern dance technique. Prerequisite: Dance 260 or consent of instructor. 2 or 3 hours, or $\frac{1}{2}$ unit (summer session, 2 hours or $\frac{1}{4}$ unit). May be repeated for a maximum of 12 hours or 2 units.
- 365. **Advanced Composition.** Work in advanced composition for the experienced student choreographer, including performance of at least one work. Prerequisite: Dance 264 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 380. **Introduction to Dance Therapy.** Introduction to dance used as therapy: lecture-discussions emphasize theoretical basis of the therapeutic process, current research trends, and assessment of movement for diagnostic or remedial purposes; fieldwork assignments with TMH children provide observational experience of actual dance therapy sessions. Prerequisite: Psychology 338; consent of instructor. 3 hours or 1 unit.
- 381. **Techniques of Dance Therapy.** Examination of general remediation techniques used in dance therapy sessions; introduction to content and methods of dance therapy with specific disability groups, such as physically or mentally handicapped and emotionally disturbed; and fieldwork experience to supplement lectures. Prerequisite: Dance 380; consent of instructor. 3 hours or 1 unit.
- 400. **Problems in Dance Education.** Basic historical, philosophical, and scientific foundations and developments in dance education; teaching methods; development of compositional problems; creative methods of instruction; and organizational problems of dance groups and public dance performance. Prerequisite: Dance 243 or 244, or equivalent. 1 unit.
- 401. **Choreography.** Experience in choreographing a minimum of one solo and one group composition to be presented at the end of the semester. Prerequisite: Dance 345 or equivalent. Students may reregister for a maximum of 2 units with the permission of the head of the department. $\frac{1}{2}$ to 2 units.
- 490. **Dance Seminar.** Student presentation of thesis reports in dance; informal discussions, demonstrations, lectures, and critical analysis of current problems in dance by professional guests. 0 credit.
- 499. **Thesis Research.** Preparation of thesis in dance. $\frac{1}{2}$ to 2 units.

ECONOMICS

Chairperson of Department: Professor P. T. Hartman

Department Office: 330 Commerce Building (West), Urbana

- 101. **Introduction to Economics.** A general survey of the operation of the economic system; emphasizes the determination of the level of national income, the pricing and allocation of products, and factors of production under existing conditions in the United States. 4 hours.

109. **Current Economic Problems.** An economic analysis of specific economic problems dealing with poverty, economic development, international economics, and other contemporary issues. Prerequisite: Concurrent registration in Economics 101. 1 hour.
171. **Introductory Economic Statistics.** An introduction to statistical methods as applied in economics and other social sciences; descriptive statistics, hypothesis testing, and estimation including contingency tables, linear statistical models, and classical time series. For noncommerce students only. Students may not receive credit for Economics 171 in addition to Economics 172 and 173, Mathematics 161, or Psychology 115. Prerequisite: Concurrent registration in Mathematics 134. 3 hours.
172. **Economic Statistics, I.** An introduction to the modern theory and methodology of statistics in the areas of economics and business; choice of best alternatives under conditions of uncertainty; frequency distributions and probability, the payoff table, and expected values as decision criteria; the cost of uncertainty and of irrationality; the use of new information; marginal, joint, and conditional probabilities; and sample design and statistical inference. Prerequisite: Mathematics 134 or equivalent; credit or concurrent registration in Economics 101 or equivalent. 3 hours.
173. **Economic Statistics, II.** Continuation of Economics 172. Emphasis on methods of estimation of basic parameters in linear models; growth curves, simple and multiple regressions, and correlation; linear combinations of ratios and percentages; index numbers, their construction and use; hypothesis testing and linear functions; and contingency tables and variance analysis. Prerequisite: Economics 172 or equivalent. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
214. **Government Finance and Taxation.** A general survey of government finance at the federal, state, and local levels, including government expenditures, principles of taxation, intergovernmental fiscal relations, public borrowing, debt management, and fiscal policy for economic stabilization. Prerequisite: Economics 101 or equivalent. 3 hours.
236. **American Economic History.** Traces the course of growth and development of the economy from the colonial period to World War I; emphasizes conceptualization of key issues of the American experience and analysis of significant episodes and turning points. Prerequisite: Economics 101 or consent of instructor. 3 hours.
238. **European Economic History.** Economic structure and development of Europe since 1000 with respect to agriculture, industry, trade, technology, finance, and government; emphasis on those forces which contribute to the economic development of Europe and on the spread of these forces throughout the world. Prerequisite: Economics 101 or consent of instructor. 3 hours.
240. **Labor Problems.** Survey of the nature and causes of the problems of the American wage earner; economic insecurity, wages, hours, substandard workers, and the efforts of wage earners and society to solve these problems through organization and legislation. Prerequisite: Economics 101 or equivalent. 3 hours.
245. **Women in the Labor Market.** Changing role of women in the labor market and the economy; supply and demand for women in the 1970s: nature, extent, and legal remedies for sex discrimination in employment; "earnings gaps" and variable employment costs, men versus women; new role of multi-earner families; and comparative use of women as a professional resource. Prerequisite: Economics 101 or equivalent. 3 hours.
255. **Comparative Economic Systems.** Analysis of the significant similarities and differences in the development, structure, and policies of capitalism, communism, and market socialism. Prerequisite: Economics 101 or equivalent. 3 hours.
272. **Introduction to Econometrics.** The use of models in the study of economic relations; single-equation least-squares; analysis of variance; and multiequation models. Prerequisite: Economics 173; Mathematics 134. Concurrent registration in Mathematics 141, 244, or 315 is recommended. 3 hours.
288. **Government Regulation of Economic Activity.** Analysis of the economic bases, policies, and consequences of government regulation of economic activity; study of eco-

conomic patterns of regulation in selected areas. Prerequisite: Economics 101 or equivalent. 3 hours.

294. **Senior Research.** A research and readings course for students majoring in economics; may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.
295. **Senior Research.** A research and readings course for students majoring in economics; may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.
299. **Undergraduate Open Seminar, II.** An independent study course covering topics not treated by regular course offerings. Requests for activation of this course may be made by students or by faculty and should be directed to the head of the department. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. Prerequisite: Junior or senior standing; Economics 101 or equivalent recommended. 0 to 9 hours. May be repeated.
300. **Intermediate Microeconomic Theory.** Microeconomic analysis including value and distribution theory; analysis of the pricing of the factors of production integrated in a micro-general equilibrium context which builds towards explaining the resource allocation process. Students may not receive graduate credit for both Economics 300 and Business Administration 400. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit. Upon recommendation by the adviser and approval by the Department of Economics, a noneconomics major may receive up to $\frac{3}{4}$ unit. Graduate credit for both Economics 300 and 400 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
301. **Intermediate Macroeconomic Theory.** The modern theory of the determination of the level and rate of growth of income, employment, output, and the price level; discussion of alternate fiscal and monetary policies to facilitate full employment and economic growth. Students may not receive credit for both Economics 301 and Business Administration 401. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit. Upon recommendation by the adviser and approval by the Department of Economics, a noneconomics major may receive up to $\frac{3}{4}$ unit. Graduate credit for both Economics 301 and 401 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
306. **History of Economic Thought.** The development of economics; the examination of contributions of individual writers and schools of thought as they influenced economic thought and national policy. Prerequisite: Economics 101 or equivalent; senior standing. 3 hours or $\frac{1}{2}$ unit.
307. **National Income and Business Forecasting.** Same as Business Administration 375. The significance of national income and related economic accounts for analysis and forecasting of business conditions; the development of interrelations between data systems used by government agencies and business concerns in program planning and current decision making; and the introduction of models for solving problems in this area. Prerequisite: Economics 101 or equivalent; Economics 171. 3 hours, or $\frac{1}{2}$ or 1 unit.
312. **Economic Dynamics and Growth.** Analysis of the causes of economic instability; the requirements for economic growth in the national economy; and a consideration of public policy relating to instability and growth. Prerequisite: Economics 101 or equivalent; Economics 301. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **Economics of Consumption.** Same as Home Economics 313. Analysis of the macro and micro aspects of consumption. Prerequisite: Economics 101 or equivalent; a course in applied statistics; junior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
315. **The Economics of Poverty and Income Maintenance.** Same as Labor and Industrial Relations 315. Analysis of the nature and causes of poverty with special emphasis on

critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.

318. **The Economics of Black America.** Examination of the effects of racial discrimination on the economic status of the black individual in America; concentration on the contemporary period; the economics of discrimination; the effect of public policies on black income, employment, and housing; and the economic development of the black community. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
328. **International Economics.** Introduction to the theory of international trade and finance with selected application to current problems of commercial policy, balance of payments adjustment, and the international monetary system. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **Contemporary Issues in the International Economy.** Analysis in depth of selected current issues and policy problems of the international economy, including (but not restricted to) the following: new approaches to the theory of international trade, reform of the international monetary system, role of the General Agreement on Tariffs and Trade and the United Nations Conference on Trade and Development in expanding trade between developed and undeveloped economies, problems of stabilizing international commodity markets, and balance of payments problems of the United States and other selected countries. Prerequisite: Economics 328 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Economic History of American Agriculture.** Same as Agricultural Economics 337 and History 337. Development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college level course in basic economics or American history. Graduate students who take this course for 1 unit credit are required to do extra work; the student writes a scholarly paper on some approved topic in agricultural history. 3 hours, or $\frac{3}{4}$ or 1 unit.
341. **The Economics of Labor Markets.** Same as Labor and Industrial Relations 341. Study of the theory and empirical research in wage determination, wage structure, economic effects of unions, and macroeconomic labor market problems. Topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; and employment and income policies. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **Unions, Bargaining, and Public Policy.** Same as Labor and Industrial Relations 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States including theory of the labor movement; process of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; and problems and policies of government intervention. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Economics of Manpower.** Same as Labor and Industrial Relations 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; and private industry and union manpower planning. Graduate credit is not given for both Economics/Labor and Industrial Relations 345 and 444. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **The Developing Economies.** Analysis of the economic problems associated with newly developing nations; emphasis on their economic structures, their factor scarcities, and their programs for development. Not open for graduate credit for graduate candidates in economics. Graduate credit is not given for both Economics 350 and Economics 450 or 451. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
352. **Economic Development in Latin America.** Same as Agricultural Economics 352. Study of economic activity and the processes of diversification and industrialization in

- Latin America, with comparative analysis of selected countries. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Economic Development in India and Southeast Asia.** Same as Agricultural Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Economic Development of Tropical Africa.** Same as Agricultural Economics 354. Types of African economies and growth of the exchange economy; development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental planning, and development projects; and demographic, land tenure, and institutional influences on development. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **Economics of Population Resources.** Studies interactions of population size with output, natural and man-made resources, and environment, and considers various policies for management of these interrelated elements; includes economics of demographic changes; and discusses both developed and developing countries. Prerequisite: Economics 101. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **The Soviet Economy.** Analytical survey of Soviet economic development; structure and performance of the economy; and problems of planning and control. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **The Economy of China.** Discussion of changes in the patterns of production, exchange, and distribution in Communist China, with emphasis on their relation to social transformation; survey of Chinese economic history over the past century, dealing with the institutional background to and the structure of economic activities in China. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **The Israeli Economy.** An analysis of the economic structures, policies, and performance of modern Israel, emphasizing the pre-1948 Palestine economy; the development of the Histadrut, Kibbutz, and Moshav; the economic relations between Arab and Jewish populations; and the impact of post-1948 immigration on Israel's economic development. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
360. **Regional Economic Development.** Survey of the theory and problems of regional economic development, including regional accounts, interregional income and trade theory, principles of the location of economic activity, theories of regional growth, and public policy for development of regions. Prerequisite: Economics 101 or equivalent. Credit is not given for both Economics 360 and 460 or 461. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **The Urban Public Economy.** Same as Finance 367. Economic analysis of public policy with respect to urban problems; a full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; and the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land-use controls, pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or $\frac{1}{2}$ or 1 unit.
374. **Mathematical Economics, I.** Mathematical reformulation and interpretation of traditional economic theory. Prerequisite: Mathematics 141 and Economics 300 and 301. 3 hours, or $\frac{1}{2}$ to 1 unit.
375. **Mathematical Economics, II.** Introduction to linear and nonlinear economic models; emphasis on the formulation and interpretation of modern economic theory and welfare economics. Prerequisite: Mathematics 124 or 315; Mathematics 141; and Economics 300. 3 hours, or $\frac{1}{2}$ to 1 unit.
384. **Economics of Transportation.** Economic aspects of the transportation industry with special emphasis on problems of regulation and public policy. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.

386. **Current Transportation Problems.** Analytical and critical study of selected problems of current interest in transportation. Prerequisite: Economics 384 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Industrial Competition and Monopoly.** The organization and tactics of market control; the development of antitrust law and policy; public policy regarding competitive practices; special policies applying to natural resource industries; and regulated monopoly and government ownership as alternatives to the antitrust approach. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
400. **General Economic Theory.** Emphasis on microeconomic theory; principal topics include a review of value and distribution theory, the theory of choice by households and firms, general microeconomic theory, and theoretical developments of current interest; and attention given to empirical studies intended to affirm or disaffirm economic principles. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 400 and Business Administration 400. Prerequisite: Economics 101 or equivalent. 1 unit. Graduate credit for both Economics 300 and 400 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
401. **General Economic Theory.** Emphasis on macroeconomic theory; principal topics include a review of Keynesian macroeconomic theory, formal growth theory, and selected business cycle theory. Intended for minors in economics and others who have a minimum preparation for graduate study in economics. Students may not receive credit for both Economics 401 and Business Administration 401. Prerequisite: Economics 101 or equivalent. 1 unit. Graduate credit for both Economics 301 and 401 is given only upon recommendation of the student's adviser and approval by the Department of Economics.
402. **Economic Theory.** Development of modern microeconomic theory: utility functions and demand; production functions and cost; linear programming; price and nonprice policy by the firm; market equilibria; income distribution; and general equilibrium including input-output analysis. Given in two sections: one offering a primarily mathematical presentation; the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics; for mathematical section, a knowledge of algebra and calculus. 1 unit.
403. **Economic Theory.** Development of modern macroeconomic theory; the Keynesian model of employment, interest, and money; its extension to international trade; fiscal policy and macroeconomic theory of distribution; the consumption function; and the theory of growth and cycles in terms of difference and differential equations. Given in two sections: one offering a primarily mathematical presentation; the other, a primarily literary presentation. Prerequisite: Economics 300 and 301, or equivalent; one semester of calculus; one semester of statistics; for mathematical section, a knowledge of algebra and calculus. 1 unit.
406. **History of Economic Thought.** Analysis of economic thought from the Physiocrats to World War II; evaluation of the selected materials both as reflections of their times and as contributions to contemporary economic thought. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
408. **Philosophical Problems in Economics.** Study of philosophical problems in economics, with some emphasis on the methodology and epistemology of economic theory; use of the views of leading economists to show the development of broad philosophical problems of economic theory, the relation of theory and certain of its applied areas, and the relation of economics to other selected disciplines. These problems are treated in the light of modern philosophy. Prerequisite: One unit either in economic theory or in the history of economic thought. 1 unit.
409. **Marxian Economics.** Analysis of Marx's economic theory and predictions; concentration on a critical evaluation of Marx's economic theory, a survey of contributions to the theory since Marx, and a Marxist evaluation of the neoclassical synthesis. Prerequisite: Economics 300 and 301, or consent of instructor. 1 unit.

- 410. Advanced Topics in Economic Theory, I.** Study at an advanced level of one or more of the following possible topics: economics of externalities, advanced aggregate economic theory, theory of central planning, investment theory, consumer behavior theory, capital theory, welfare economics, inflation theory, income distribution theory, or other topics. Prerequisite: Economics 402 and 403, or consent of instructor. 1 unit. May be repeated.
- 411. Advanced Topics in Economic Theory, II.** Study at an advanced level of one or more of the following possible topics: economics of externalities, advanced aggregate economic theory, theory of central planning, investment theory, consumer behavior theory, capital theory, welfare economics, inflation theory, income distribution theory, or other topics. Prerequisite: Economics 402 and 403, or consent of instructor. 1 unit. May be repeated.
- 414. Public Finance.** Analysis of government expenditures and decision making; the budgetary process; fiscal policy; government borrowing and debt management; intergovernmental fiscal relations; pricing of government services; and public finance in developing economies. Prerequisite: Six hours of economics. 1 unit.
- 415. Economics of Taxation.** Principles of taxation; incidence and distribution of tax burden; economic analysis of the major taxes: the personal and corporate income taxes, sales and excise taxes, property tax, and others; and taxation and economic development. Prerequisite: Six hours of economics. 1 unit.
- 416. Public Goods Theory.** An analysis of the theory of public goods; includes welfare economics, externality, and market failure; and applications to cost benefit analysis, optimal taxation, public choice, fiscal federalism, and income distribution. Prerequisite: Economics 402. 1 unit.
- 418. Economics of Education, Health, and Human Capital.** Basic economic analysis of human capital and the value of human time, with applications to the economics of education and health; theory and analysis of consumer investment in human and physical capital over the life cycle; the returns to education and health, and their effects on growth; the theory of nonmarket time; public finance of education and health; and implications for the analysis of the distribution of income. Prerequisite: A course in microeconomic theory and a course in statistics, or consent of instructor. 1 unit.
- 420. Monetary Theory.** Critical examination of monetary theories and their neoclassical antecedents; topics include the quantity theory, liquidity preference, the demand for money, velocity, theories of the level and term structure of interest rates, asset theory, and money in static and dynamic macro-general equilibrium models. Prerequisite: A course in income and employment theory or consent of instructor. 1 unit.
- 421. The Theory of Monetary Policy.** Use of theories of central banking, debt management, financial intermediaries, and the monetary behavior of firms and households to explore current issues in the theory of monetary policy; current empirical research reviewed with emphasis on econometric studies of monetary behavior. Prerequisite: A course in money and banking, in macroeconomic theory, calculus and statistics, or consent of instructor. 1 unit.
- 425. Macroaccounting.** Same as Accountancy 455. Examination of the fundamental concepts underlying the attempts to measure the economic activities of macro-units; similarities and contrasts of accounting problems, theoretical and practical, of the business enterprise and of national or regional units in relationship to existing systems of accounting measurement; macroaccounting statements and analyses; and usefulness of macroaccounting techniques and data in evaluating national and regional goals. Prerequisite: Intermediate macroeconomic theory or consent of instructor. 1 unit.
- 428. International Trade Theory.** Development and use of the neoclassical theory of international trade for the analysis of tariffs, customs, unions, and the effects of trade on the distribution of income and welfare; analysis and use of the relations between the balance of payments and national income to study the role of income changes combined with price changes in the balance of payments adjustment process. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.

429. **International Trade Policy.** Concepts of balance of payments equilibrium, the foreign exchange market and the theory of capital movements; current problems and policies related to balance of payments disequilibrium, trade policy, and the functioning of the international monetary system. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
436. **American Economic History.** Emphasizes, but is not limited to, the reading and criticism of current literature in American economic history; attempts to facilitate understanding of the use of economic analysis in interpreting events framed in historical context; includes British colonial policy, trade and tariffs, industrialization, technology, slavery and the southern economy, land policy, agriculture, transportation and internal improvements, capital mobilization and financial organization, and the measurement of economic growth. Prerequisite: Graduate standing in economics or consent of instructor. 1 unit.
437. **General Economic History.** Treatment of selected topics in the economic history of industrialized economics by applying economic theory and quantitative methods of analysis to historical problems; exploration of the implications for contemporary work in economics. Prerequisite: Graduate standing in economics or consent of instructor. 1 unit.
438. **Economic History of Europe.** Major lines of development since 1450; comparative study of forces and institutions inimical or favorable to growth; and selected readings on organization of economic activity, role of governments and the entrepreneur, commercial policy, monetary systems, land tenure, process of capital formation, industrialization, etc. Prerequisite: Consent of instructor. 1 unit.
440. **Labor Economics.** Same as Labor and Industrial Relations 440. Survey of recent trends in the labor force, of real and money earnings, and of the distribution of national income used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.
441. **Labor Economics.** Same as Labor and Industrial Relations 441. Economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free enterprise economy); emphasis in all cases on the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
442. **Collective Bargaining.** Same as Labor and Industrial Relations 442. Development of a theory of the continuing interactions between unions and management which define and modify the role of each and the terms of employment; use of appropriate social science concepts; and emphasis on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority, and on the interactions between the parties and governmental process. Prerequisite: Consent of instructor. 1 unit. Graduate credit is not given for both Economics 343 and Economics/Labor and Industrial Relations 442.
443. **Problems and Practices of Labor Dispute Settlement.** Same as Labor and Industrial Relations 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling; analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit.
444. **Economics of Manpower Resources.** Same as Labor and Industrial Relations 444. Emergence of the manpower resource issue; population as a resource base; the labor force: measurement and characteristics, behavior under changing income, employment, and technology; women as the dynamic factor in labor force growth; problems of utilization of labor force components: intellectual resources, older workers, and manual, white collar, Negro, and marginal forces; and issues of national manpower policy. Graduate credit is not given for both Economics/Labor and Industrial Relations 345 and 444. Prerequisite: Consent of instructor. 1 unit.
447. **Labor Union Organization and Administration.** Same as Labor and Industrial Relations 447. Analysis of the structure, functions, and government of the modern American

trade union movement; survey of the environmental factors, objectives, and action programs with considerable emphasis on economic and internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit.

450. **The Economics of Development and Growth.** Review and analysis of the theories and patterns of growth in developed and underdeveloped economies; consideration of the problems and methods of measuring growth; critical examination of the variables thought to be strategic in the growth process; and exploration of the policy implications of different theories. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
451. **The Developing Economies.** Analysis of the newly developing economies, with emphasis on institutional factors affecting development and economic policy relating to development. Prerequisite: Economics 450. 1 unit.
455. **Comparative Economic Systems.** Comparative analysis of the structures and policies of market-directed and planned economies. Prerequisite: Economics 101 or equivalent. 1 unit.
457. **Economic Planning in the Soviet Union and Eastern Europe.** Intensive examination of the structure and performance of the Soviet and the East European economies, emphasizing analysis of the main theoretic and operational dimensions of economic planning; evaluation of choice, design, and efficacy of central planning instruments from both theoretical and historical perspectives. Prerequisite: Economics 300 and 301, or 357, or consent of instructor. 1 unit.
460. **Location Theory.** Theory of location of economic activity in modern economic analysis; synthesis and application of production and location theories to regional structure and interregional and international trade and development. Credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301, or equivalent. 1 unit.
461. **Urban and Regional Economic Development.** Measurement and analysis of interregional differences in economic growth. Credit is not given for both Economics 360 and 460 or 461. Prerequisite: Economics 300 and 301. 1 unit.
467. **Mathematical Economics, I: Statics.** Study of quantitative techniques useful in economic analysis and decision making; mathematical programming; input-output analysis; point-set theory and game theory; existence, optimality, and stability conditions for static general equilibrium; and activity analysis, including welfare economics. Prerequisite: Mathematics 315; Economics 402 and 403, or equivalent. 1 unit.
468. **Mathematical Economics, II: Dynamics.** Study of quantitative techniques useful in economic analysis and decision making; single and systems of difference and differential equations; dynamic programming; Pontryagin maximum principle; interaction of multiplier and accelerator; von Neumann model; Turnpike theorem; growth models; and control systems. Prerequisite: Mathematics 315; Economics 402 and 403, or equivalent. 1 unit.
470. **Economic Statistics.** Classical statistics and regression analysis; descriptive statistics, probability and point and interval estimation; decision theory; variance analysis; and linear regression and least-squares estimates. Prerequisite: A course in statistics or consent of instructor. 1 unit.
471. **Econometric Analysis.** Part 1: the construction of econometric models; characteristics of models and choice of estimating methods; and estimates of parameters by various methods. Part 2: Bayesian statistics and decision theory. Prerequisite: Economics 470 or equivalent. 1 unit.
476. **Econometrics, I.** Estimation of parameters for single-equation models; tests of hypotheses and confidence regions for regression models; large-sample theory in single-equation models; and Bayesian statistics in regression models. Prerequisite: Mathematics 315 and 363. 1 unit.
477. **Econometrics, II.** Consideration of the specification of models with systems of simultaneous equations; identification problem, distributed lag models, K-class estimators,

maximum likelihood estimators, three-stage least-squares, and effects of specification errors. Prerequisite: Economics 476. 1 unit.

479. **Research Seminar in Quantitative Economics.** Significant work in the area of quantitative economics is reported and explored by members of the instructional staff, by guest speakers from academic, governmental, and industrial centers, and by graduate students in the second year of their work who are assigned projects. Prerequisite: The equivalent of one year of graduate statistics (theoretical or applied). 1 unit. (Credit for second-year students only.)
480. **Industrial Organization.** Theory of the organization of markets and firms, behavior of firms, functioning of competitive systems, and performance of markets. 1 unit.
481. **Industrial Organization and Public Policy.** Economic aspects of public policy relating to the maintenance of competition, public utility regulation, and natural resource regulation; survey of other forms of regulation and market organization in other countries. Prerequisite: Economics 480. 1 unit.
484. **Economics of Transportation, I.** Study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. 1 unit.
485. **Economics of Transportation, II.** Continuation of Economics 484. 1 unit.
490. **Individual Study and Research.** Directed reading and research. $\frac{1}{4}$ to 1 unit.
491. **Workshop and Research Seminar.** Workshops are offered in all areas of specialization in which graduate students are writing Ph.D. dissertations. The specific format varies, but in general workshop sessions include presentations by graduate students of thesis research, by faculty members of their current research, and by occasional outside speakers. Prerequisite: Admission to the Department of Economics Ph.D. program. $\frac{1}{2}$ unit. One unit of Economics 491 is required of all students in the Ph.D. program.
499. **Thesis Research.** Preparation of thesis required of all students writing master's or doctoral theses in economics. 0 to 4 units (summer session, 0 to 2 units).

EDUCATION

Dean of College: Dean J. M. Atkin

College Office: 110 Education Building, Urbana

100. **Education Practicum.** A laboratory course involving work in school and research projects of the instructor's choosing. For those who choose this option, it is taken in conjunction with Speech Communication 111 and 112, and Educational Policy Studies 201. 4 hours.
101. **Education Practicum.** Continuation of Education 100. Prerequisite: Education 100 or consent of instructor. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
399. **Issues and Developments in Education.** For experimentation or for seminar on topics not treated by regularly scheduled courses; requests for initiation of course may be made by students or faculty members. Prerequisite: Consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. Not more than 8 hours or 2 units may be counted toward a degree.
424. **Practicum in Education.** Provides the student with intensive supervised experiences in applied educational theory and in developmental educational projects requiring field experience. Prerequisite: Consent of instructor. 0 to 2 units. Not more than 2 units may be counted toward a degree.
449. **Independent Study.** Offers opportunity of self-directed independent study, that is, develops the individual's ability as an independent student and enables the student to pursue interdisciplinary studies for which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the co-

ordinator of graduate study prior to enrollment. $\frac{1}{2}$ or 1 unit. Not more than 2 units may be counted toward an advanced degree except by consent of the dean of the College of Education.

490. **Seminar for Advanced Students of Education.** Seminar in education open only to students admitted for doctoral study in education; upon approval of the dean of the College of Education, sections will be formed to consider unique and promising developments in education. Prerequisite: Consent of instructor. 1 to 2 units. Not more than 4 units may be counted toward a degree.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units (summer session, 0 to 2 $\frac{1}{2}$ units).

EDUCATIONAL POLICY STUDIES

Chairperson of Department: Professor A. Peshkin

Department Office: 363 Education Building, Champaign

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Foundations of American Education.** A study of some of the problems of formulating and justifying aims and policies in American education, of designing and systematizing the curriculum, of organization and social context of the public school system, and of the teaching-learning process; examined in terms of perspectives provided by social philosophy, history, sociology, and philosophy of education. Prerequisite: Psychology 100. 3 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; and consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
300. **The History of Education.** Brief introductory survey of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance; emphasis on the relation of educational trends to broader social, economic, political, and intellectual movements. Prerequisite: Junior standing. 3 hours or $\frac{1}{2}$ unit.
301. **Philosophy of Education.** Philosophical examination of selected educational issues; conveys a grasp of the complexities of the issues and some philosophical methods for dealing with them. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
302. **History of American Education.** The development of American education in relation to political, social, and cultural developments; attention to the influence of movements in the cultural environment upon evolving conceptions of educational theory and practice. 2 hours or $\frac{1}{2}$ unit.
303. **Comparative Education.** Introduction to the cross-cultural, cross-national study of educational institutions and their relationship to society; focus on schooling in both developing and industrialized nations. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
304. **Social Foundations of Education.** Introductory survey of the interrelationship between school and society, and of the impact on public education of the major social trends and forces operating in our society. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
305. **History of Educational Ideas.** Study of selected educational theorists and intellectual movements; provides familiarity with the major educational ideas of the past and historical perspectives on current issues and problems in education; and readings in such

authors as Aristotle, Plato, Quintilian, St. Augustine, Loyola, Comenius, Rousseau, Pestalozzi, Froebel, Herbart, and Dewey. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

306. **Introduction to Aesthetic Education.** Philosophic introduction to the problems of teaching for critical judgment and appreciation; examination of materials from aesthetics, art history, and criticism for relevance to problems of aims, curriculum, organization, and teaching-learning; and attention to problems of interrelated arts and humanities programs. Designed for prospective teachers of art, music, literature, and related subjects. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
307. **Aesthetics, Mass Media, and Education.** Introduction to the philosophic problems of teaching for developing critical judgment and appreciation of the mass media; use of materials drawn from aesthetics, communication theory, and the social sciences if relevant to the educational problems of aims, curriculum, organization, and teaching-learning. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit.
308. **Contemporary Movements in Philosophy of Education.** A survey of trends and schools of thought in contemporary philosophy of education, including systematic, pragmatic, analytic, and existentialist philosophies of education. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
315. **Sociology of Education.** Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods; main emphasis on present education in countries which share Western civilization. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **Anthropology of Education.** Same as Anthropology 385 and Educational Psychology 385. Introduction to the contribution of anthropology to the cross-cultural study of education, including discussion of material from representative cultures ranging from primitive social groups to present-day national states; special attention to education of minority ethnic and subordinate cultures; and emphasis on both informal and formal education as cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: A course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
386. **Education and International Relations.** Analysis of the role of education in international relations, emphasizing the study of educational innovation through the help of foreign aid programs. Prerequisite: Educational Policy Studies 303 or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
399. **Issues and Developments in Educational Policy Studies.** Seminar on topics not treated by regularly scheduled courses; requests for initiation may be made by students or faculty members. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a maximum of 8 hours or 2 units.
400. **Problems of Educational Theory.** Analysis of the kinds of problems encountered in constructing an educational theory, and of relations between educational theory and other disciplines, especially philosophy and the social sciences. Prerequisite: Educational Policy Studies 301 or 308, or equivalent; consent of instructor. 1 unit. May be repeated.
401. **Modern Theories of Education.** Critical analysis of the theories of education represented by the work of Robert M. Hutchins, James Conant, and Ivan Illich. Prerequisite: Educational Policy Studies 301 or equivalent; consent of instructor. 1 unit.
402. **Educational Movements in the Twentieth Century.** Historical study of significant educational trends during the past sixty years, with special reference to their influence on American education; an analytical examination of the principal transition movements in the last decade of the nineteenth century and of efforts to solve the problems since 1900. 1 unit.
403. **The Historical Foundations of American Educational Thought.** Study of the evolution of educational theories and philosophies since the eighteenth century; particular reference to their impact upon educational developments in the United States; a broad view of the general growth of American educational thought; and attention to selected major educational theorists, or schools of thought, exploration of their fundamental ideas,

and the relation of these ideas to significant intellectual currents in American culture. Prerequisite: Consent of instructor. 1 unit.

404. **Seminar in Educational Classics.** Reading and group discussion of a limited number of the most important writings in educational philosophy which have had a profound influence on the progress of educational thought and practice. Prerequisite: Educational Policy Studies 305 or equivalent; consent of instructor. 1 unit.
405. **Foundations of Aesthetic Education.** Philosophical approach to the problems of teaching for appreciation in formal education; appraisal of the status of aesthetic education, its nature and function, and its relation to other types of education. Prerequisite: Educational Policy Studies 306 or equivalent; consent of instructor. 1 unit.
406. **Seminar in the History of Education.** Intensive group study of a small number of selected problems to assist individual students to develop an understanding of and the ability to use the techniques of historical research in furthering such study; problems studied are selected in the light of the interests and previous training of the group of students enrolled. Prerequisite: Two courses in the history of education and one course in the philosophy of education, or consent of instructor. 1 unit. Offered in alternate years.
407. **Logical Foundations of Methods.** Study of the application of principles of logic (broadly construed) to methods and curriculum at all levels. Prerequisite: Educational Policy Studies 301 or equivalent; teaching experience. 1 unit.
408. **Epistemology in Education.** Exploration of knowledge and inquiry as they relate to problems of formulating educational policy, curriculum design, organization of the educational system at all levels, and teaching-learning. Prerequisite: Educational Policy Studies 301 and 1 unit of epistemology (for example, Philosophy 329, 330, or 371), or equivalent; consent of instructor. 1 unit.
409. **Values and Education.** Study of the nature of value as it relates to problems of formulating and justifying educational aims and policies, curriculum design, organization of the educational system at all levels, and teaching-learning. Prerequisite: Educational Policy Studies 301 and 1 unit of ethics or value theory, or equivalent; consent of instructor. 1 unit.
410. **Seminar in Theories of Educational and Social Change.** Designed to help prospective educational leaders acquire an understanding of current theories of social change as these relate to educational institutions. There is now an extensive body of knowledge on the nature and control of social change. This needs to be made available to all prospective educational leaders in order that they may go about their duties with greater understanding and skill. Designed to aid students in bringing this knowledge to bear upon the problems of leadership in educational and social change. Prerequisite: Educational Policy Studies 304 or equivalent. 1 unit.
411. **Philosophy of Educational Research.** Examination of some crucial assumptions and concepts of contemporary research in education from the point of view both of the consumer and the practitioner of educational research. Prerequisite: Educational Policy Studies 301; a course in the quantitative treatment of educational data, or the equivalent. 1 unit.
412. **Seminar: Dewey's Philosophy of Education.** Critical study of John Dewey's philosophy of education involving intensive study of original works. Prerequisite: Educational Policy Studies 301 and 308, or equivalent; consent of instructor. 1 unit.
413. **Seminar in Educational Concepts.** Some significant concepts, such as equality, authority, freedom, neutrality, indoctrination, objectivity, and teaching, are selected and examined in depth. Prerequisite: Educational Policy Studies 301; an analytic philosophy course, or equivalent; consent of instructor. 1 unit. May be repeated.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may

be offered toward an advanced degree except by consent of the Dean of the College of Education.

483. **Methods in Comparative Education.** Designed to develop skills and understanding for field work related to the comparative cross-national and cross-cultural study of education; includes problems of both a pedagogical and social science nature. Prerequisite: Consent of instructor. 1 unit.
484. **Education in the Industrialized Nations.** Examination of educational and national policy in industrialized nations; topics include education and political integration, socialization, economic growth and manpower development, social status and mobility, and educational planning; particular attention given to Western Europe, the USSR, and North America. Prerequisite: Educational Policy Studies 303 or 386, or consent of instructor. 1 unit.
485. **Education in the Developing Countries.** Analysis of the role and functions of education in social, political, and economic development, with particular reference to the new and the developing countries. Prerequisite: Educational Policy Studies 303 or 386, or consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in educational policy studies; sections offered in the following fields: (a) history of education; (b) philosophy of education; (c) comparative education; (d) social foundations of education; (e) philosophy of educational research; and (f) historical methods in education. Prerequisite: Consent of instructor. 1 unit. May be repeated.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; students are expected to present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

EDUCATIONAL PRACTICE

Offices for Student Teaching: Secondary Education, 140 Education Building; Elementary Education, 304 Education Building; Special Education, 140 Education Building; and Vocational and Technical Education, 140 Education Building.

Students entering teacher education curricula with 60 or more semester hours should apply for student teaching assignments during the first semester in the curriculum. However, such students must complete at least a semester before they may be admitted to educational practice.

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
220. **Educational Practice in the Education of Exceptional Children.** A course in practice teaching which provides teaching experience with exceptional children. Prerequisite: Senior standing; consent of department; sufficient hours of background courses. 2 to 8 hours.
232. **Educational Practice in Elementary Education.** A course in practice teaching to meet certification requirements for teaching in the elementary school. Prerequisite: Elementary and Early Childhood Education 233, 234, or 237 as required by the student's curriculum; senior standing. 2 to 8 hours.
238. **Educational Practice for Special Fields in Elementary Schools.** A course in student teaching to meet requirements for certification in special fields at the elementary school

- level. Prerequisite: For students in the early childhood education curriculum, Elementary and Early Childhood Education 334 required; consent of instructor. 3 to 8 hours.
239. **Microteaching: Practice in Teaching Techniques.** Instruction and practice in basic teaching techniques; consideration of both teacher-centered and learner-centered techniques; systematic examination of each technique in terms of basic descriptive and evaluative procedures; and application of techniques to specific instructional situations. Prerequisite: Junior standing. 2 hours.
242. **Educational Practice in Secondary Education.** A course in practice teaching to meet certification requirements for teaching in the secondary school. Prerequisite: Secondary Education 240; senior standing. 2 to 8 hours.
250. **School and Community Experiences.** Observation and laboratory experience in the public schools to prepare students for student teaching. 2 hours.

EDUCATIONAL PSYCHOLOGY

Chairperson of Department: Professor J. L. Wardrop
Department Office: 210 Education Building, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
211. **Educational Psychology.** Basic undergraduate course in psychology of education for prospective teachers; materials and principles from the various areas of psychology (mental hygiene, psychology of learning, etc.) applied to the practical problems of teaching. Prerequisite: Psychology 100. 3 hours.
236. **Child Development for Elementary Teachers.** Study of child growth and development designed particularly for those preparing to teach in the elementary school; special emphasis on the significance of the developmental process for educational programs and procedures; and systematic experience in studying and evaluating children's behavior and in handling children. Prerequisite: Psychology 100. 3 hours.
249. **Independent Study.** Study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructor; consent of adviser and staff member who supervises the work. 1 to 4 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
311. **Psychology of Learning for Teachers.** Consideration of learning situations in the light of psychological findings and concepts; development of a theory of learning and its application to the teaching of attitudes, skills, and understandings. Prerequisite: Educational Psychology 211; practice teaching or teaching experience. 2 hours or ½ unit.
312. **Mental Hygiene and the School.** Examination of social and emotional adjustment; study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, and behavior disorders in children; and introduction to methods of child study and provision for emotionally disturbed children. Prerequisite: Educational Psychology 211; practice teaching or teaching experience. 2 hours or ½ unit.
313. **Programmed Instruction.** Design, production, and evaluation of self-instructional materials, including delineation of objectives, task analysis, frame writing, frame editing, pilot testing and revision, and field testing; survey of current research and orientations toward programmed instruction; and consideration of the mechanized and text forms for presenting programs. Each student prepares a self-instructional program. Prerequisite: Educational Psychology 311. 4 hours or 1 unit.
326. **Introduction to Vocational Rehabilitation Counseling.** Survey of the history and development of vocational rehabilitation programs; contributions of related disciplines

- and their integration; and basic procedures and problems of vocational rehabilitation counseling, including work with special groups such as drug addicts, the physically handicapped, and public offenders. Prerequisite: Consent of instructor. 4 hours or 1 unit.
339. **Corrective Reading.** Same as Elementary and Early Childhood Education 339. Practice in administering and interpreting group diagnostic reading tests; presentation of instructional techniques appropriate for less severe reading disabilities. Prerequisite: Elementary and Early Childhood Education 336 or 338. 3 hours or 1 unit.
343. **Individual Intelligence Testing.** Fundamental concepts relevant to the general problem of the individual testing of learning aptitude; acquisition of psychometric competence in the use of the 1960 Binet and the Wechsler tests; and acquaintance and limited practice in the administration, scoring, and interpretation of results obtained by performance scales and other devices appropriate for use with individuals having sensory, associative, and/or motor impairments. Prerequisite: Consent of instructor and 6 hours of psychology and Special Education 324, or Educational Psychology 392 or Psychology 390. 3 hours or 1 unit.
360. **Educational Uses of Television and Radio.** Same as Radio and Television 360. Study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; and experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.
362. **Adult Learning and Development.** Same as Administration, Higher, and Continuing Education 362. Theory of and research on adult learning and development; includes societal context, performance, physiology and health, personality, and learning; and considers stability and change during young adulthood, middle age, and old age. Prerequisite: Educational Psychology 311 or 312, or equivalent. 4 hours or 1 unit.
385. **Anthropology of Education.** Same as Anthropology 385 and Educational Policy Studies 385. Introduction to the contribution of anthropology to the cross-cultural study of education; discussion of material from representative cultures ranging from primitive social groups to present-day national states; special attention to education of minority ethnic and subordinate cultures; and emphasis placed on both informal and formal education as cultural process in relation to culture transmission, evolution, change, and development. Prerequisite: One course in anthropology or sociology, or consent of instructor. 2 or 4 hours, or ½ or 1 unit.
387. **Computer Use in Education.** Overview of the nature and development of automation in education; use of electronic data processing systems for administrative purposes, for instruction, and for research; discussion of problems of computer management, natural language analysis, and simulation CAI applications; and laboratory experience with on-line terminals, remote entry devices, and peripheral equipment. Prerequisite: Educational Psychology 390 or equivalent, or consent of instructor. 3 hours or 1 unit.
390. **Elements of Educational Statistics.** Designed for terminal value for professional training of students not intending to pursue advanced graduate work, and for introductory value for students continuing graduate study in education; descriptive statistics, introduction to correlation and regression, the normal curve, statistical inference, and the presentation and interpretation of statistical data in educational literature. 3 hours or 1 unit.
391. **Construction and Use of Tests in Teaching.** The relationship of classroom testing to educational objectives and the curriculum; the construction, administration, and scoring of the various types of essay and short-answer tests; and other means of measuring the attainment of objectives and marking procedure. Designed primarily for classroom teachers. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.
392. **Introduction to the Principles of Measurement.** Study of the selection, preparation, administration, and interpretation of psychological and educational tests and diagnostic devices; emphasis on theory at a beginning level, with application to hypothetical

school situations as a teaching device; and consideration of the sources of standard tests, criteria for their evaluation, methods of scoring, interpretation, and general and special areas. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.

399. **Issues and Developments in Educational Psychology.** Experimentation or seminar on topics not treated by regularly scheduled courses. Requests for initiation of the course may be made by students or by faculty members. 2 or 4 hours, or ½ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
411. **Psychology of Adolescence for Teachers.** Psychological significance of adolescence, its biological and social foundations, and its implications for education. Prerequisite: Educational Psychology 311 and 312. 1 unit.
412. **Advanced Child Development for Students of Education.** Considers the nature of the child and the child's development during the preschool and elementary school years; emphasis on development as a process of social learning; interpretation of the scientific literature as it concerns the educative process; and discussion of methods of studying and evaluating the behavior of the child as an individual and in group situations. Prerequisite: Educational Psychology 311 and 312. 1 unit.
413. **Social Psychology and the Problems of Education.** Consideration of the concepts and methods of social psychology as applied to the professional functions of teachers, administrators, and other persons engaged in education; opportunity to work upon field problems. Prerequisite: Educational Psychology 311, 312, and 390. 1 unit.
414. **The Psychology of College Teaching.** Designed particularly for graduate students minor-ing in education or preparing for college teaching. Psychoeducational problems in undergraduate and graduate teaching; special emphasis upon individual differences, remedial procedures, principles of learning, the technology of teaching and learning, adjustment problems of college students, counseling and advisory services, test construction, and analysis and use of test results and resource materials. Prerequisite: A course in psychology; consent of instructor. 1 unit.
415. **Psychological Theories Applied to Education.** An advanced course in human behavior; special attention given to contemporary systems of psychology and their relationship to educational practice. Prerequisite: Educational Psychology 311 and 312; Educational Psychology 411 or 412; candidacy for Ed.D. or Ph.D. in Education. 1 unit.
422. **Basic Principles of Counseling.** Study of counseling processes that are especially applicable to the problems of normal individuals; study of the theories of education and personality which underlie counseling procedures for the purpose of developing the student's ability to evaluate these procedures. Prerequisite: Educational Psychology 311 and 312. 1 unit.
423. **The Use of Tests in Guidance.** Practice in interpreting test results in case studies; study of the implications on test choices and usage of the philosophic orientation of the counselor, the type of case, the case setting, and the case information available; and discussion of the advantages and disadvantages of particular tests for given types of cases. Prerequisite: Educational Psychology 390, 392, and 422, or equivalent. 1 unit.
424. **Supervised Practice in Educational Psychology.** Intensive supervised experiences in applied educational psychology; use of a wide variety of diagnostic and observational techniques and treatment. Students may take more than one section. Prerequisite: Master's degree in educational psychology or equivalent; consent of instructor. 1 to 2 units.
425. **Principles and Practices of Student Personnel Services.** For teachers, administrators, student advisers, and others who are interested in basic guidance principles and in guidance methods useful to schools and to agencies dealing with out-of-school youth and adults; consideration of the role of guidance specialists and the guidance functions of community agencies. 1 unit.
427. **Principles and Techniques of Group Guidance.** Study of the principles of group guidance and their application; review of the historical development of group guidance and the study of pertinent research. Discussion and role playing have an important part in

- the work of the course, and case materials are utilized. Prerequisite: Educational Psychology 311, 312, 422, 423, and 425; or consent of instructor. 1 unit.
428. **Theories of Career Development and the Use of Occupational Information.** Results of recent occupational research and use of these results by teachers and counselors; attention given to research techniques suitable for use in local occupational studies. Prerequisite: Educational Psychology 425 or an introductory course in counseling. 1 unit.
429. **Field Instruction in Educational Psychology.** Individual instruction designed to help the advanced student apply basic principles of education or psychology in institutional settings. Each student is assigned to a school, community agency, or other applied settings for a supervised field experience in some aspect of educational psychology. Prerequisite: Master's degree in educational psychology or equivalent, and consent of instructor. 1 to 4 units. May be repeated to a maximum of 4 units; no more than 2 units may be taken in any given semester.
440. **Social Development.** Research and theory relating to the social development of children; special attention to processes of social learning, environmental influences on social behavior, and the role of education in facilitating the development of social skills; and emphasis on experimental research conducted in naturalistic settings. Prerequisite: Educational Psychology 236 or Psychology 216, or equivalent; and Educational Psychology 390, Psychology 235, or equivalent. 1 unit.
444. **Sociocultural Influences on Learning and Development.** Research and theory relating to the origin and development of achievement-related attitudes, motives, norms, and expectations; issues and problems associated with teaching children of diverse backgrounds. Prerequisite: Educational Psychology 311, 312, and 390, or consent of instructor. 1 unit.
446. **Research Methods in Human Development.** Introduction to methods and the design of research appropriate to the study of child and adult development; consideration of cross-disciplinary approaches, observational and experimental methods, methods for the assessment of social change, and the study of intergenerational differences in behavior. Prerequisite: Educational Psychology 496 or equivalent; 4 units of graduate work in education or the social or behavioral sciences. 1 unit.
447. **Seminar in Rehabilitation Counseling.** Problems of rehabilitation, including problems associated with specific physical and mental disabilities; critical examination of literature pertaining to rehabilitation, with emphasis on recent publications. Prerequisite: Educational Psychology 326 and 422. $\frac{1}{2}$ unit. May be repeated to a maximum of 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study; develops the individual's ability as an independent student; and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
460. **Field Research in Educational Settings.** Examination of the conduct of research in educational settings with a focus on researcher-practitioner research collaboration; considers social psychological and design aspects of field research. Students engage in research in cooperation with local schools. Prerequisite: Educational Psychology 390 or equivalent, and consent of instructor. 1 unit.
485. **Multivariate Correlational Techniques in Educational Research.** Emphasis on educational research applications of correlational techniques; special attention to issues in principles of research design underlying appropriate uses of such techniques as multiple, partial, and part (semipartial) correlation and factor analysis; and illustration of techniques by examples drawn from published studies and projects conducted on this campus. Emphasis will be placed on application and interpretation of techniques rather than on theoretical rationales. Prerequisite: Educational Psychology 496 or equivalent; consent of instructor. 1 unit.

487. **Classroom Transactions and Student Outcomes.** An advanced course in the investigations of relationships between classroom transactions and student outcomes; major topics include the methodology of observing and measuring classroom events, review of correlational and experimental research in classroom settings, and the design of future research in this area. Prerequisite: Educational Psychology 496 or consent of instructor; background work in educational theory assumed. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in educational psychology open only to persons who have been admitted for doctoral study in educational psychology. 0 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems. Students are expected to present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
492. **Psychology of Learning and Instruction.** Same as Psychology 492. An advanced course in the nature and conditions of long-term cognitive learning and retention in classroom and similar situations; intended for doctoral students with a special interest in research leading to the improvement of classroom teaching and learning, in psychological aspects of curriculum research, and in the cognitive aspects of military and industrial training. Prerequisite: Consent of instructor. 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Psychology 494 and Sociology 494. Principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
495. **Theories of Measurement.** Same as Psychology 495. Classical test theory (true score, error of measurement, reliability and validity of test scores, composite measures); proposed alternatives to the classical model (generalizability theory, matrix sampling, latent trait theory, criterion-referenced measurement). Prerequisite: Educational Psychology 496 or Psychology 307, or equivalent; Educational Psychology 392 or Psychology 390, or equivalent. 1 unit.
496. **Statistical Methods in Education.** Introduction to inferential statistical methods in education; includes probability theory, distribution theory, interval estimation, hypothesis testing, regression and correlational analysis, and analysis of variance. Prerequisite: Educational Psychology 390 or equivalent. 1 unit.
497. **Advanced Statistical Methods in Education.** Advanced topics in analyses of variance and covariance, and principles of experimental design; brief introduction to multivariate analysis, including rudiments of matrix algebra. Prerequisite: Educational Psychology 496, Psychology 307, or equivalent. 1 unit.
498. **Theories of Educational Evaluation.** Study of the process of educational program evaluation, its purpose and procedures, with emphasis on settings, personnel, and performance; review of principal theories; and study of models, histories, political contexts, ethics, and epistemology of evidence as they relate to the observation, judging, and reporting of educational programs. Prerequisite: Educational Psychology 390 and 392, or consent of instructor. 1 unit.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

ELECTRICAL ENGINEERING

Head of Department: Professor E. C. Jordan

Department Office: 155 Electrical Engineering Building, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Seminar.** Discussions of educational programs, career opportunities, and other topics in electrical engineering. For electrical engineering students. 0 hours.
220. **Basic Electrical Engineering.** Fundamentals of electric and magnetic circuits and characteristics of electron tubes and circuits. Credit is not given for both Electrical Engineering 220 and 260. Prerequisite: Physics 106 and 107; Mathematics 140, 141, or 145. 3 hours. Electrical engineering students receive no credit.
229. **Introduction to Electromagnetic Fields.** Elementary electromagnetic field theory as summarized in Maxwell's equations in integral and differential form; wave propagation; and energy and power in electromagnetic fields. Prerequisite: Physics 107; Mathematics 345. 3 hours.
244. **Electrical Engineering Laboratory, I.** Introduction to electronic instruments, basic measurement techniques, and basic electronic components; preparation for experimental projects. Prerequisite: Credit or concurrent registration in Electrical Engineering 260. 2 hours.
245. **Electrical Engineering Laboratory, II.** Laboratory projects in various areas of electrical engineering. Prerequisite: Electrical Engineering 244 and 340, or consent of instructor. 2 hours.
246. **Project Laboratory.** Planning, designing, executing, and evaluating various experimental projects by the student along with discussion of the actual examples of experimental design, error control, and data processing. Prerequisite: Senior standing in electrical engineering; consent of instructor. 2 to 4 hours.
249. **Digital Systems Laboratory.** Introduction to the experimental analysis and synthesis of digital networks. Prerequisite: Electrical Engineering 244 and 290; credit or concurrent registration in Electrical Engineering 340; or consent of instructor. 2 hours.
260. **Networks, I.** Elementary signals; basic principles of network analysis; and sinusoidal steady-state analysis. Credit is not given for both Electrical Engineering 260 and 220. Prerequisite: Physics 107; credit or concurrent registration in Computer Science 101; Mathematics 345. 3 hours.
266. **Probabilistic Methods in Electrical Engineering.** Applications of probabilistic concepts in electrical engineering problems; models of random phenomena in devices and systems; and elementary analysis and design problems involving statistical models in electrical engineering. Prerequisite: Electrical Engineering 260 or junior standing in electrical engineering. 3 hours.
271. **Electrical Engineering Special Topics.** Prerequisite: As specified by department or instructor. 0 to 4 hours.
272. **Electrical Engineering Problems.** Prerequisite: Approved written application to department as specified by department or instructor. 0 to 4 hours.
288. **Economic Aspects of Engineering.** Fundamental principles of engineering economy. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours. Students may not receive credit for both Electrical Engineering 288 and General Engineering 288.
290. **Introduction to Information Processing.** Engineering perspective to information processing from a computational standpoint; comparison and contrast of analog and digital systems to provide an appreciation of their respective characteristics and capabilities. Prerequisite: Computer Science 101; credit or concurrent registration in Mathematics 345. 3 hours.
296. **Honors Project.** A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

297. **Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Preliminary reading and investigation. 0 to 3 hours.
302. **Electronics and Acoustics of Music, I.** History of music, science and technology; spectra of basic sound signals and concept of voltage control; electronic circuits for sound synthesis; sound pressure measurement; sound perception; basics of acoustic wave propagation; and acoustics of string, wind, and percussion instruments. Credit is not given for both Music 302 and Electrical Engineering 302. Prerequisite: Electrical Engineering 342; Electrical Engineering 350 or 373. 3 hours or $\frac{3}{4}$ unit.
303. **Electronics and Acoustics of Music, II.** Acoustics of the voice; intervals, scales, tuning, and temperament; auditorium and room acoustics; artificial reverberation; microphones and loudspeakers; sound reinforcement; feedback problems; recording and reproduction of sound; and digital computer sound-processing techniques. Credit is not given for both Music 303 and Electrical Engineering 303. Prerequisite: Electrical Engineering 302. 3 hours or $\frac{3}{4}$ unit.
306. **Electronics and Instrumentation.** Design and operation of electronic circuits for instrumentation; basis of design is the terminal characteristics of components, devices, and modules; manufacturers' specifications are used whenever available. Emphasis on the use of approximations and development of circuits for practical applications and construction. Not available for students in electrical engineering. May not be taken for graduate credit by engineering students. Prerequisite: Physics 107 and credit or concurrent registration in Electrical Engineering 307, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
307. **Electronics and Instrumentation Laboratory.** Laboratory to accompany Electrical Engineering 306. Not available for students in electrical engineering. May not be taken for graduate credit by engineering students. Prerequisite: Credit or concurrent registration in Electrical Engineering 306 or equivalent, or consent of instructor. 1 hour or $\frac{1}{4}$ unit.
308. **Transforms in Circuit and System Analysis.** Role of exponential and sinusoidal signals in system analysis; Fourier series; Laplace and Fourier transforms and their utilization in circuit and system analysis; convolution; complex frequency analysis; stability; and sampling and discrete system analysis. Prerequisite: Electrical Engineering 260. 3 hours, or 0 to $\frac{3}{4}$ unit. Students in electrical engineering may not receive graduate credit for Electrical Engineering 308.
310. **System Modeling and Analysis.** Role of exponential and sinusoidal signals in system analysis; Fourier series; Laplace and Fourier transforms and their utilization in circuit and system analysis; convolution; complex frequency analysis; stability; and sampling and discrete system analysis. Prerequisite: Electrical Engineering 260. 3 hours or $\frac{3}{4}$ unit. Students in electrical engineering may not receive graduate credit for Electrical Engineering 310.
320. **Computational Methods for Circuit Analysis.** Matrix algebra; LU decomposition; formulation of network equations; AC analysis; sensitivity; adjoint network; feedback and stability; algorithms for pole-zero determination; DC analysis of electronic circuits; transient analysis; tolerance analysis; and optimization of circuits. Prerequisite: Electrical Engineering 308 or 310. 3 hours, or $\frac{3}{4}$ or 1 unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Same as Nuclear Engineering 321. Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems; energy balance; plasma confinement and stability; and recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.
324. **Active and Passive Filter Design.** Properties of passive network functions; synthesis of RC and LC passive network functions; operational amplifier; RC active circuit synthe-

- sis; sensitivity of networks; approximation theory; and practical filter design. Prerequisite: Electrical Engineering 308 or 310. 3 hours, or $\frac{3}{4}$ or 1 unit.
328. **Application and Control of Electromechanical Devices.** Electric codes, manufacturers' standards, motor types and applications, and control devices and systems. May not be taken for credit by students in electrical engineering. Prerequisite: Electrical Engineering 220 or 260, and credit or concurrent registration in Electrical Engineering 329. 3 hours or $\frac{3}{4}$ unit.
329. **Electromechanical Devices Laboratory.** Laboratory to accompany Electrical Engineering 328. May not be taken for credit by students in electrical engineering. Prerequisite: Credit or concurrent registration in Electrical Engineering 328. 1 hour or $\frac{1}{4}$ unit.
330. **Electromechanics.** Quasi-static electromagnetic fields; lumped-parameter electromechanics; rotating machines; dynamics of electromechanical systems; and fields and moving media. Prerequisite: Electrical Engineering 229 and 260. 3 hours, or 0 to 1 unit.
332. **Induction Motors and D. C. Machines.** The fundamentals and applications of single- and three-phase induction motors and D. C. machines. Prerequisite: Senior standing. 3 hours or $\frac{3}{4}$ unit.
335. **Electrical Machinery Laboratory.** A study of the performance characteristics of transformers and AC and DC rotating machines by laboratory methods. Prerequisite: Credit or concurrent registration in Electrical Engineering 332 or 336. 2 hours or $\frac{1}{2}$ unit.
336. **Transformers and Synchronous Machines.** Transformers, polyphase transformer connections, synchronous generators, synchronous motors, and parallel operation of synchronous machines. Prerequisite: Senior standing. 3 hours, or 0 to 1 unit.
337. **Control Structure of Computers.** Same as Computer Science 337. Asynchronous, synchronous, and microprogrammed control structures in the framework of computer architecture; interlocking of autonomous subcontrols; and case studies in typical control features: instruction look-ahead, multiprocessing interrupt, and input/output. Prerequisite: Computer Science, Electrical Engineering, or Mathematics 391 or Computer Science 221, or consent of instructor. 3 hours or 1 unit.
340. **Electronics, I.** Semiconductor materials and their electronic properties and applications to electronic devices; p-n junctions, transistors, and other diode and triode devices; and low-frequency applications of diodes. Prerequisite: Physics 108; Mathematics 345. 3 hours, or 0 to $\frac{3}{4}$ unit.
342. **Advanced Electronics.** Linear and nonlinear amplification; modulation and demodulation concepts; and introduction to feedback amplifiers and oscillators. Prerequisite: Electrical Engineering 244, 260, and 340. 3 hours, or 0 or $\frac{3}{4}$ unit.
344. **Theory and Fabrication of Solid State Devices.** Laboratory and lecture course on the physical theory, design, and fabrication of solid state devices; includes the electronic properties of semiconductors (such as mobility, carrier concentration, lifetime, energy gap), and techniques for fabricating (oxidation, diffusion, oxide masking, alloying) p-n junction devices. Prerequisite: Electrical Engineering 340. 4 hours or 1 unit.
346. **Hybrid Circuit Fabrication Laboratory.** Laboratory course on the basics of fabricating thin- and thick-film components as used in hybrid electronic circuits; experiments covering vacuum deposition, sputtering, anodization, resist processes, screen preparation, screen printing, and firing and trimming. Lectures provide background material and cover trade-offs of the two technologies. Prerequisite: Electrical Engineering 344. 2 hours or $\frac{1}{2}$ unit.
350. **Lines, Fields, and Waves.** Wave equation, free and guided wave propagation, waveguides, and radiation. Prerequisite: Electrical Engineering 229 and 260. 3 hours or $\frac{3}{4}$ unit.
351. **Microwave Laboratory.** Laboratory analysis at UHF and microwave frequencies. Prerequisite: Electrical Engineering 350. 2 hours, or 0 to $\frac{1}{2}$ unit.

352. **Electromagnetic Fields.** Plane waves at oblique incidence, wave polarization, anisotropic media, radiation, space communications, and waveguides. Prerequisite: Electrical Engineering 350. 3 hours, or $\frac{3}{4}$ or 1 unit.
353. **Radio Communication Circuits.** Design of a radio system for transmission of information; types of receivers, matching techniques, receiver and antenna noise, types of modulation, high-frequency circuitry, and point-to-point and satellite communications. Prerequisite: Electrical Engineering 260; credit or concurrent registration in Electrical Engineering 350. 4 hours or 1 unit.
354. **Antennas.** Antenna parameters; polarization of electromagnetic waves; basic antenna types; antenna arrays; broadband antenna design; and antenna measurements. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 3 hours or 1 unit.
355. **Optical Electronics.** Optical beams and cavities; semiclassical theory of gain; characteristics of typical lasers; and application of optical devices. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 3 hours or 1 unit.
358. **Applications of Radio Wave Propagation.** Terrestrial atmosphere, radio wave propagation, and applications to radio sensing and radio communication. Prerequisite: Electrical Engineering 350 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
359. **Analog and Pulse Communication Systems.** Introduction to amplitude, phase, frequency, and pulse code modulation systems; discusses bandwidth requirements, effects of noise and applications in commercial broadcast, and telephone and satellite communications. Prerequisite: Electrical Engineering 308 or equivalent; credit or registration in Electrical Engineering 266 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
361. **Introduction to Digital Communication Systems.** Introduction to signals and noise in digital communication systems; analysis and design of efficient digital communication receivers; and signal design for, and performance of, practical communication systems. Prerequisite: Electrical Engineering 266 and 308, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
364. **Introduction to Computer Arithmetic.** Same as Computer Science 364. Review of binary number representations, logical design of adders and arithmetic units, and simple multiplication and division methods; multiplier recoding; redundant division methods; design of carry-save adders and signed-digit arithmetic units; and case studies of high-speed arithmetic units. Prerequisite: Computer Science 264. 3 hours or 1 unit.
367. **Active Networks.** Study of active device models and their application to electrical network equation forms; expression of systems in terms of their network functions; examination of the characteristics of feedback systems in particular; and examination of sensitivity and stability factors. Prerequisite: Electrical Engineering 342. 3 hours or $\frac{3}{4}$ unit.
368. **Solid-State Motor Drive Systems.** General principles of solid-state motor drives using silicon-controlled rectifiers and integrated circuits; discussion of drive systems and components including inverters, frequency converters, motors, generators, and control systems; and industrial applications. Prerequisite: Electrical Engineering 330 and 342. 3 hours or $\frac{3}{4}$ unit.
369. **Semiconductor Device and Linear IC Applications Laboratory.** Laboratory study of applications of unijunction transistors, silicon-controlled rectifiers, triacs, field effect transistors, and linear integrated circuits such as differential amplifiers, operational amplifiers, and linear communications integrated circuits. One hour of lecture and a three-hour laboratory each week. Prerequisite: Electrical Engineering 342. 2 hours or $\frac{1}{2}$ unit.
371. **Topics in Electrical Engineering.** Lectures and discussions relating to new areas of interest. Prerequisite: Specified by department or instructor. 0 to 4 hours, or 0 to 1 unit. May be repeated.
372. **Basic Aeronomic Processes.** Aeronomic aspects of gas kinetic theory; energy levels of atomic and molecular atmospheric species; emission and absorption bands and continua; atomic collision processes; chemical kinetics; photochemistry or oxygen allotropes and nitrogen and hydrogen oxides; transport mechanisms; plasma properties; and lab-

- oratory measurements. Prerequisite: Physics 383 or consent of instructor. 3 hours or 1 unit.
373. **Engineering Acoustics.** Same as Theoretical and Applied Mechanics 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems; vibrating string; vibrating membrane; plane waves; spherical waves; vibrating piston; acoustical filters; loudspeakers and microphones; principle of reciprocity; the ear; and architectural acoustics. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
374. **Ultrasonic Techniques.** Ultrasonic wave propagation, generation, detection, and measurement in liquid and solid media; acoustic impedance concepts; ultrasonic absorption phenomena; piezoelectricity; and discussion of selected industrial, experimental, and bioengineering applications with laboratory demonstrations. Students may not receive credit for both Electrical Engineering 373 and 374. Prerequisite: Mathematics 345. 3 hours or 1 unit.
375. **Modeling of Bio-Systems.** Same as Bioengineering 375. Application of linear systems theory and feedback control systems analysis to biological systems; sensory receptors, neuro-muscular system models, control of eye movement, the pupil control system, man-machine interactions, parameter identification in biological systems; and optional project laboratory. Prerequisite: General Engineering 222, Mechanical Engineering 265, Aeronautical and Astronautical Engineering 271, or Electrical Engineering 308 or 310; or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
376. **Symmetrical Component Analysis of Power Systems.** Representation of power systems; symmetrical component; positive, negative, and zero sequence impedances of network components; sequence networks; unsymmetrical faults; unsymmetrical power systems; and matrix algebra in symmetrical component analysis. Prerequisite: Senior standing. 3 hours, or 0 or 1 unit.
377. **Biomedical Instrumentation.** Same as Bioengineering 377. Introduction to engineering aspects of the detection, acquisition, processing, and display of signals from living systems; emphasizes biomedical transducers for measurements of biopotentials, pH, pCO₂, pO₂, force, displacement, pressure, flow, temperature, and impedance; and optional laboratory with animal experiments. Prerequisite: Electrical Engineering 244 and 260, or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
378. **Steady State Power Systems.** Power system design, steady state power system analysis, computer solutions, and economic dispatch. Prerequisite: Senior standing. 3 hours, or 0 to 1 unit.
379. **Pulse and Digital Laboratory.** Laboratory to accompany Electrical Engineering 380. Prerequisite: Credit or concurrent registration in Electrical Engineering 380. 1 hour or $\frac{1}{4}$ unit.
380. **Pulse and Digital Circuits.** Analysis and design of circuits in which nonlinearities of the active devices are a significant factor or in which the signals are primarily pulses; generation, transmission, and processing of such signals appropriate for small-scale instrumentation as well as to large systems such as computers. Prerequisite: Electrical Engineering 260, 340, and 290; credit or concurrent registration in Electrical Engineering 379, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
381. **Introduction to Computer Memories and I/O.** Same as Computer Science 381. Introduction to memories, input/output devices, and optical processors; lecture and demonstration. Prerequisite: Computer Science 281, Electrical Engineering 340, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
383. **Principles and Application of Linear Integrated Circuits.** Techniques of analysis and synthesis of linear integrated circuits, concentrating on linear integrated circuit biasing systems, building blocks, differential amplifiers, operational amplifiers, and integrated circuits used in communications; analysis of integrated circuits by hand calculations and by specialized computer analysis programs. Prerequisite: Electrical Engineering 342. 3 hours or $\frac{3}{4}$ unit.

384. **Information and Signal Processing by Computing Devices.** Same as Computer Science 384. Operation and theory of computing devices for signal and information processing; analog, digital, and stochastic information representation and processing; and conversion of information representation from one type to another. Prerequisite: Computer Science 264 and 281, or Electrical Engineering 290 and 340, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
385. **Semiconductor Computer Devices.** Same as Computer Science 385. The theory of bipolar junction transistors and the fabrication of monolithic integrated logic circuits; unipolar field effect device properties, theory, fabrication, and application to logic and memories. Prerequisite: Computer Science 281, Electrical Engineering 340, or equivalent. 3 hours or 1 unit.
386. **Control Systems, I.** Analysis and design of control systems with emphasis on modeling, state variable representation, computer solutions, modern design principles, and laboratory techniques. Prerequisite: Electrical Engineering 310 or consent of instructor. 4 hours or 1 unit.
387. **Introduction to Quantum Electronics for Electrical Engineers.** Introduction for the senior electrical engineering student to the application of quantum mechanical concepts to electronics problems; specifically, application of elementary quantum mechanics to the detailed study of a calculable two-state laser system; and incidental quantum ideas bearing on electronics. Prerequisite: Physics 383 or consent of instructor. 3 hours or 1 unit.
389. **Digital Computer Circuit Design.** Same as Computer Science 389. Design of switching circuits and systems taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data-handling links; and consideration of component tolerance, circuit reliability, and cost factors. Prerequisite: Computer Science 264 or Electrical Engineering 290 and either Computer Science 281 or Electrical Engineering 340. 3 hours or 1 unit.
390. **Introduction to Optimization.** Basic theory and methods for the solution of optimization problems; iterative techniques for unconstrained minimization; and introductory presentation of linear and nonlinear programming with engineering applications. Prerequisite: Computer Science 101 or Mathematics 343, or consent of instructor. 3 hours or 1 unit.
391. **Switching Theory.** Same as Computer Science 391 and Mathematics 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Computer Science 264, Electrical Engineering 290, or Mathematics 319, or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Computer Science 392 and Mathematics 392. Synchronous machines: state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines: state assignment, hazards, and interacting machines. Prerequisite: Mathematics 319 and Computer Science/Electrical Engineering/Mathematics 391, or consent of instructor. 3 hours or 1 unit.
396. **Computer Displays and Peripherals.** Same as Computer Science 386. Theory and operation of computer displays and peripheral devices; human and machine aspects; and available techniques and devices. Prerequisite: Electrical Engineering 381 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
397. **Projects and Lectures in Quantum Electronics.** Study of processes involving quantum mechanical energy transfers in energized media leading to various laser devices and their applications. A series of lectures, supplementing the special projects, offers background information on spectroscopy, collisional energy transfer, laser pumping schemes, modulation at optical frequencies, holography, and other related topics. Prerequisite: Senior standing; consent of instructor; Electrical Engineering 387 recommended. 3 hours, or 0 to 1 unit.

400. **Seminar.** Required of all graduate students. 0 credit.
414. **Engineering Applications of Linear Graphs.** Same as Computer Science 414. Elementary theory of linear graphs; Euler graphs; incidence, cut-set, and circuit matrices and their properties; realizability of cut-set, circuit, and tree matrices; applications to network analysis and synthesis; signal flow graphs; applications to switching circuits and automata; and communication networks. Prerequisite: Electrical Engineering 416; Mathematics 315 or 318. 1 unit.
415. **Control System Theory and Design.** Synthesis of feedback control systems to meet design specifications, including sensitivity; multivariable systems; introduction to systems with random inputs; state variable techniques; and nonlinear systems. Prerequisite: Electrical Engineering 386 or equivalent, or consent of instructor. 1 unit.
416. **Analysis of Networks and Systems.** Dynamic equations of linear lumped networks and systems; time-domain analysis and state space methods; frequency-domain analysis and transform methods; stability criteria; and applications to various problems in electrical engineering. Prerequisite: Electrical Engineering 308 and 310. 1 unit.
418. **Electric and Magnetic Fields.** Rigorous treatment of basic laws, static fields, typical field systems, harmonic functions, conjugate functions, and conformal transformation. 1 unit.
420. **Electromagnetic Waves and Radiating Systems.** Fundamental electromagnetic theory with applications to transmission lines, waveguides, and antennas; introduction to the solution of advanced problems in static electric and magnetic fields. Prerequisite: Electrical Engineering 352. 1 unit.
421. **Advanced Electromagnetic Engineering.** Reciprocity and equivalence principles; formulation of scattering and diffraction problems; approximations for large and for short wavelengths; plane, cylindrical, and spherical wave problems; variational methods; Wiener-Hopf techniques; and applications to antennas and waveguide problems. Prerequisite: Electrical Engineering 420. 1 unit.
422. **Controlled Fusion Systems.** Same as Nuclear Engineering 422. Development of plasma models for fusion analysis; treatment of plasma heating and confinement with applications to current experiments; and energy balances and energy extraction, minimum-B configuration, instability criteria, Tokamak machines, pinch systems, and mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
423. **Gaseous Electronics and Plasmas.** Basic concepts and techniques, both theoretical and experimental, which are used in the areas of gaseous electronics, gas and solid plasmas, controlled fusion, aeronomy, gas lasers, and magnetohydrodynamics. Prerequisite: Physics 383 or Electrical Engineering 352, or equivalent, or consent of instructor. 1 unit.
425. **Nuclear-Electrical Energy Conversion.** Same as Nuclear Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection; analysis and applications of direct collection of charged particles; and theory and applications of radiation-induced ionization and excitation. 1 unit.
428. **Analysis of Nonlinear Systems.** Same as Theoretical and Applied Mechanics 428. Treatment of singular points and stability considerations; consideration of graphical and analytical methods, including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
431. **Theory of Guided Waves.** Propagation in general cylindrical waveguides; eigenvalue problems, stationary principles, microwave circuit theorems, boundary value problems, and the determination of circuit parameters; and periodically loaded waveguides with anisotropic media. Prerequisite: Electrical Engineering 420. 1 unit.
432. **Compound Semiconductors (Optical Devices).** Properties of III-V and II-VI compound semiconductors and the devices which are unique to these materials; emphasis on materials such as GaAs, Ga(AsP), GaP, CdSe, Cd(SeS), etc., and on luminescence, semiconductor lamps, and semiconductor lasers. Prerequisite: Graduate standing in

electrical engineering with some background in modern physics; elementary quantum mechanics; elementary semiconductor theory or equivalent. 1 unit.

433. **Theory of High-Speed Parallel Computation.** Same as Computer Science 433. Theoretical aspects of parallel and pipeline computation; time and processor bounds on classes of computations; data alignment network speed and cost bounds; conflict-free access memories; and overall computer system ideas. Prerequisite: Computer Science 333 or equivalent. 1 unit.
434. **Random Processes.** Basic concepts of random processes; spectral analysis; linear systems with random inputs; Markov chains and Markov processes; and applications to communications and control systems engineering. Prerequisite: Mathematics 361 or equivalent, or Electrical Engineering 361. 1 unit.
435. **Theory of Semiconductors and Semiconductor Devices.** Same as Physics 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high-frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; and characteristics of p-n junctions, heterojunctions, and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
437. **Principles of Microwave Measurements.** Generation and detection of the laboratory signal; the generalized impedance concept; matrix representation of waveguide discontinuities; determination of equivalent network parameters; analysis of measurement techniques by signal flow graphs; and accuracy criteria. Prerequisite: Electrical Engineering 355. 1 unit.
439. **Advanced Theory of Semiconductors and Semiconductor Devices.** Continuation of Electrical Engineering 435. Selected advanced topics of current interest in the physics of semiconductors and solid-state devices. Prerequisite: Electrical Engineering 435. 1 unit.
440. **Advanced Power Circuit Analysis, I.** Analysis of power systems by symmetrical and related components; equivalent circuits of lines, transformers, and machines; fault calculations on symmetrical and unsymmetrical power systems; and the network analyzer in fault studies. 1 unit.
444. **Introduction to Artificial Intelligence.** Same as Computer Science 444. Introduction to basic concepts in artificial intelligence with emphasis on computer understanding of natural language concepts; formal representations of natural language concepts, data structure, and list processing; linguistic analysis including both syntactic and semantic processing; automatic logic deduction and theorem proving; and survey of applications to systems including question answering, information retrieval, and problem solving. Prerequisite: Consent of instructor. 1 unit.
445. **Power System Stability.** Transient and steady-state stability in power systems; power flow equations; transient stability swing curves; critical clearing time; the network analyzer in stability studies; and the analog computer in transient stability studies. Prerequisite: Electrical Engineering 440. 1 unit.
451. **Digital Processing of Signals.** Sampling theorem; the fast Fourier transform and its application in the digital processing of signals; design of finite impulse response digital filters; theory and design of recursive digital filters including round-off errors and limit cycles; and surface wave filters. Prerequisite: Electrical Engineering 310 or equivalent. 1 unit.
452. **Time-Varying and Nonlinear Circuits.** Energy considerations; equations in normal form; frequency power relations in nonlinear networks; frequency conversion; Lyapunov's direct method; the circle stability criterion; and calculus of variations and Hamilton's principle applied to the stability and matching problems. Prerequisite: Electrical Engineering 416; Mathematics 346. 1 unit.
453. **Optimum Control Systems.** Formulation of the optimization problem; controllability; observability; stability; Lyapunov's second method; application of variational calculus, maximum principle, and principle of optimality to control problems; stochastic control; and adaptive control. Prerequisite: Electrical Engineering 415. 1 unit.

454. **Sampled-Data Control Systems.** Analysis and design of feedback control systems with digital and sampled data. Prerequisite: Electrical Engineering 415 or equivalent. 1 unit.
456. **Coding Theory.** Same as Computer Science 456. General discussion on coding theory with emphasis on the algebraic theory of cyclic codes; error-control procedures and circuits; and applications to computers and data-transmission systems. Prerequisite: Mathematics 317 or equivalent, or consent of instructor. 1 unit.
461. **Signal Detection and Estimation.** Introduction to detection and estimation theory, with applications to communication, control, and radar systems; decision-theory concepts and optimum-receiver principles; detection of random signals in noise, coherent and noncoherent detection; and parameter estimation, linear and nonlinear estimation, and filtering. Prerequisite: Electrical Engineering 434 or equivalent, or consent of instructor. 1 unit.
463. **Information Theory.** Same as Computer Science 463 and Mathematics 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361 or equivalent. 1 unit.
464. **Topics in Digital Computer Arithmetic.** Same as Computer Science 464. Topics selected from the advanced theory of digital computer arithmetic, including division methods, use of redundancy, and implications of the use of number representations, such as continued products and continued fractions. Prerequisite: Computer Science/Electrical Engineering 364. 1 unit.
465. **Topics in Automata Theory.** Same as Computer Science 465 and Mathematics 465. Topics selected from mathematical systems and automata theory, decision problems, formal languages, decomposition theory, etc. Prerequisite: Electrical Engineering 392 or consent of instructor. 1 unit.
468. **Advanced Solid-state Electrical Energy Conversion Systems.** Principles of solid-state electrical energy conversion systems; emphasis on the theory and operation of various types of inverters, converters, and cycloconverters; and applications including uninterrupted computer power supplies, electric automobiles, trucks, locomotives, earth-moving equipment, off-highway vehicles, industrial automation, and power system distribution. Prerequisite: Graduate standing. 1 unit.
469. **Introduction to Coherent Optics and Holography.** Same as Computer Science 469. The diffraction transformation of aperture distributions between parallel planes and the imaging and Fourier-transforming properties of lenses; the theory of coherence; the principles of optical and digital holography; and devices and systems for optical data processing. 0 or 1 unit.
470. **Nonlinear Optics.** Light propagation in anisotropic crystals; second- and third-order nonlinear susceptibility and electro-optic effect; and discussion of the relationship of these effects along with such applications as light modulation, harmonic generation, and optical parametric amplification and oscillation. Prerequisite: Electrical Engineering 420. 1 unit.
472. **Quantum Electronics.** Brief theoretical introduction to quantum mechanics and atomic physics, with many applications in spin resonance and modern maser theory. Prerequisite: Physics 362 and 385 recommended. 1 unit.
475. **Ionospheric Radio Propagation.** Propagation in a stratified medium; WKB solution; ray theory; ionospheric sounding; ionospheric transmission problems; scattering by irregularities; propagation in a random medium; cross-modulation and nonlinear effects; magneto-ionic theory; Faraday effect; whistler propagation; coupling of characteristic waves; magnetohydrodynamic waves; formation of ionospheric E-region; and formation of F-region. Prerequisite: Electrical Engineering 420 or equivalent. 1 unit.
477. **Advanced Antenna Theory.** Selected topics from recent engineering literature on antennas supplemented by advanced topics in electromagnetic theory needed for comprehension; current techniques for analysis of wire, slot, horn, frequency independent, quasi-optical, and array antennas. Prerequisite: Electrical Engineering 420. 1 unit.

- 485. **Topics in Computer Hardware.** Same as Computer Science 485. Advanced features of computer hardware; topics vary, but typically are chosen from: memories, optical data processing and storage, device modeling and computer-aided circuit design, and stochastic representation and processing of information. Prerequisite: Consent of instructor. 1 unit.
- 486. **The Constitution and Behavior of the Upper Atmosphere.** Chemical and dynamical processes in the upper atmosphere; emphasis on the processes by which emitted solar energy is transformed and the resulting behavior of the atmosphere and ionosphere. Prerequisite: Electrical Engineering 372 or consent of instructor. 1 unit.
- 488. **Experimental Techniques in Aeronomy.** Principles and typical results of measurement techniques for studies of the neutral and ionized constituents of the earth's upper atmosphere; radio techniques, probes, mass spectrometers, photometers, and particle detectors. Prerequisite: Graduate standing in electrical engineering or physics. 1 unit.
- 490. **Seminar in Special Topics.** Lectures and discussions on current research and literature on advanced topics in electrical engineering. Prerequisite: Advanced standing; consent of instructor. 0 to 1/2 unit. May be repeated for credit.
- 497. **Electrical Engineering Problems.** Lectures and discussions relating to new areas of interest. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated for credit.
- 498. **Individual Study.** Individual projects. Prerequisite: Consent of instructor. 1/2 to 2 units.
- 499. **Thesis Research.** 0 to 4 units.

ELEMENTARY AND EARLY CHILDHOOD EDUCATION

Chairperson of Department: Professor J. D. Rath

Department Office: 311 Education Building, Urbana

- 199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
- 230. **Principles, Problems, and Issues in Elementary and Early Childhood Education.** Focuses on the problems and issues facing the classroom teacher in curriculum development, planning, and evaluation; develops and applies educational principles which serve to guide the teacher in dealing with these problems and issues. Prerequisite: For students pursuing the B.S. in elementary education, concurrent registration in Educational Practice 232. For students pursuing the B.S. in early childhood education, Elementary and Early Childhood Education 234 and concurrent registration in Educational Practice 232. 3 hours.
- 233. **Classroom Programs in Childhood Education.** Organizing balanced daily programs in childhood education; planning and using materials of instruction; and evaluating pupil achievement. Prerequisite: Junior standing; Educational Psychology 236. 2 hours.
- 234. **Theory and Process in Early Childhood Education.** Directed toward assisting the preservice teacher to understand his or her role in implementing curriculum in early childhood settings; deals with topics such as evaluation, communication, cognition, and working with parents; and includes an eight-week practicum in local elementary and nursery schools and day care centers. Prerequisite: Educational Psychology 236. 5 hours.
- 237. **Theory and Process in Elementary School Teaching.** Directed toward affecting prospective teacher insight with regard to classroom behavior in teaching; includes materials dealing with child learning, teaching theory, and elementary school curriculum. A six-week morning assignment to a public school classroom is part of the course structure. Prerequisite: Educational Psychology 236. 5 hours.
- 249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing

competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.
292. Thesis. Prerequisite: Senior standing. 2 hours.
304. **Literature for Elementary School Children.** Examines literature written for children and the uses of literature in the elementary school curriculum. Prerequisite: One college course in literature. 3 hours or 1 unit. Students may not receive credit for both Elementary and Early Childhood Education 304 and Library Science 303.
331. **Teaching Social Studies in the Elementary School.** Emphasis on the role of social education in the elementary school; the formal instructional program in social studies, including the knowledge, skills, and sensitivities to be taught; the teaching strategies and materials employed; and the organization of learning experiences and the total program in addition to the educative impact of the elementary school as a social system. Prerequisite: Elementary and Early Childhood Education 234 or 237; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
332. **Principles and Practices in Elementary Mathematics Education.** Organization, scope, and sequence of the elementary mathematics program and the functional nature of mathematics; methods, techniques, experiences, and materials of value in teaching elementary mathematics, and the role of classroom teacher. Prerequisite: Mathematics 202 and 203, or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
333. **The Teaching of Language Arts in the Elementary School.** Goals, content, and teaching problems involved in the devising of programs in the area of elementary school language arts that are cumulative and sequential from kindergarten through the elementary school. Prerequisite: Elementary and Early Childhood Education 234 or 237; Educational Psychology 236. 3 hours, or $\frac{1}{2}$ or 1 unit.
334. **Principles and Practices in Early Childhood Education.** Study of the principles and practices of using play as an educational tool in early childhood education; review of historical, philosophical, and psychological foundations of nursery-kindergarten methods; assessment of techniques relating play to various aspects of instruction; survey of materials and equipment; and presentation of methods of classroom evaluation. Prerequisite: Elementary and Early Childhood Education 234. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **Science in the Elementary School.** The principles, place, and practice of science education in the elementary school and in the lives of children; stresses the functional nature of science and its place in the curriculum; and considers the organization of the science program, experiences and techniques of value in teaching, and the role of the classroom teacher and specialist. Opportunity for experience in field and laboratory work. Prerequisite: Elementary and Early Childhood Education 237, or equivalent; two years of college science. 3 hours or $\frac{1}{2}$ unit.
336. **Fundamentals of Reading Techniques.** Same as Secondary Education 336. Basic principles, techniques, and materials for the developmental reading program; emphasis on methods and materials which provide for differentiated instruction. Prerequisite: Junior standing; registration in a teacher education curriculum. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Art Education in the Elementary School.** Methods, plans, and materials for teaching art as an integral part of the total educational program in the elementary school. Prerequisite: Junior standing. 3 hours or $\frac{1}{2}$ unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Secondary Education 338. Developmental reading programs beyond the primary grades; factors related to reading speed and comprehension; and vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary and Early Childhood Education 336 or Educational Psychology 211; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
339. **Corrective Reading.** Same as Educational Psychology 339. Practice in administering and interpreting group diagnostic reading tests; presentation of instructional techniques appropriate for less severe reading disabilities. Prerequisite: Elementary and Early Childhood Education 336 or 338. 3 hours or 1 unit.

- 344. Parent Involvement Techniques for Teachers.** Principles and practices in working with parents in programs of involvement, education, and participation for elementary and early childhood teachers; includes techniques of reporting to parents, counseling with parents, guiding parent participation in schools, and developing relations with community agencies. Prerequisite: Elementary and Early Childhood Education 234 or graduate standing. 3 hours or 1 unit.
- 348. Speech and Language Clinical Methods in the Schools.** Same as Speech and Hearing Science 348. Study of methods and materials used in the schools by the speech and language clinician. Prerequisite: Speech and Hearing Science 388. 3 hours or ½ unit.
- 354. Audio-Visual Communication.** Same as Library Science 354 and Secondary Education 354. Analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or ½ or 1 unit.
- 399. Issues and Developments in Elementary and Early Childhood Education.** A special course for experimentation or for seminar on topics not treated by regularly scheduled courses; requests for initiation may be made by students or faculty members. 2 or 4 hours, or ½ or 1 unit. May be repeated to a maximum of 8 hours or 2 units toward any one degree.
- 431. Elementary School Classroom Programs.** Exploration of organizational centers for determining selection and sequence of educative experiences in the elementary school classroom; emphasis on the role of the teacher in curriculum construction. 1 unit.
- 432. Clinical Diagnosis and Remediation in Reading.** Supervised experience in the reading center; special attention to evaluative and interpretative techniques in cases of severe reading disabilities based on the analysis of specific reading needs. Prerequisite: Elementary and Early Childhood Education 339; a course in individual mental testing. 1 unit. May be repeated to a maximum of 2 units.
- 433. Curriculum Problems and Trends in Special Fields of Elementary and Early Childhood Education.** Study of the place of the various special fields of elementary education in the emerging elementary school curriculum, with a review and analysis of recent trends and research findings in these fields. Sections are usually offered in the following fields: (a) language arts; (b) social studies; (c) mathematics; (d) science; (e) creative arts; (f) reading; (g) early childhood education; (h) teacher education; and (i) open education. Prerequisite: For all sections, Elementary and Early Childhood Education 431 or 434, or consent of instructor; for the section in language arts, Elementary and Early Childhood Education 333 and 336, or a course in the teaching of reading or language arts, or consent of instructor; for the section in creative arts, Elementary and Early Childhood Education 337 or consent of instructor; for the section in science, Elementary and Early Childhood Education 335 or a methods course in teaching science in the elementary school and two years of college science, or consent of instructor; for the section in reading, Elementary and Early Childhood Education 336 or a course in teaching of reading, or consent of instructor; for the section in early childhood education, Elementary and Early Childhood Education 434 or consent of instructor. 1 unit.
- 434. Programs in Early Childhood Education.** Advanced course intended primarily for teachers and supervisors of younger children, ages three to eight; review and analysis of research findings, experimentation, and current trends in curriculum organization, procedures, and materials essential to developing classroom programs for children. 1 unit.
- 435. Diagnosis and Correction in Elementary Mathematics.** The nature, causes, and correction of mathematical difficulties at the elementary level; process of evaluation through group and individual procedures; the development and use of diagnostic instruments and corrective techniques; and supervised experience with pupils having difficulties. Prerequisite: Elementary and Early Childhood Education 332 and Educational Psychology 392, or equivalent. 1 unit. May be repeated to a maximum of 2 units.

436. **Field Instruction in Reading Programs.** Directed practice in the area of reading; students are placed in an approved and supervised field position for part of the semester. Prerequisite: Elementary and Early Childhood Education 432. 1 unit.
437. **Methods of Child Study.** Study of ways in which teachers can evaluate child behavior and development with emphasis on classroom application; instruction and practice in the use and interpretation of observations, anecdotal records, rating scales, interviews, achievement tests, intelligence tests, questionnaires, and sociometric and projective techniques. Prerequisite: Educational Psychology 312 or consent of instructor. 1 unit.
438. **The Organization and Supervision of School Reading Programs.** Study of procedures for planning, improving, and evaluating reading programs on a system-wide basis. Open only to those persons who are preparing to supervise reading programs or with approval of graduate adviser. Prerequisite: Elementary and Early Childhood Education 339; Elementary and Early Childhood Education 433 (reading section). 1 unit.
439. **Fundamentals of Curriculum Development.** Same as Secondary Education 439. Explores the several theoretical bases of curriculum planning and the implications of these approaches for practice. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student, and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the Dean of the College of Education.
459. **Workshop in Curriculum Development.** Curriculum development projects in specialized fields of elementary and early childhood education. 1 unit. May be repeated to a maximum of 2 units toward any one degree.
490. **Seminar for Advanced Students of Education.** Seminar in elementary and early childhood education. Prerequisite: Admission to doctoral study in elementary and early childhood education. 0 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems. Students are expected to present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
493. **Research and Design in Curriculum Development.** Criteria and procedures for evaluating reported research and for conducting research studies by professional educators at all levels, particularly those involved in teaching, modifying, or developing educational programs; considers researchable problems, development of research designs, selection of analyses for design and data, and utilization of results in findings and conclusions. (1) Section A is directed toward practitioners in education, and includes consumption and use of reported research and conducting of research in field situations, with emphasis on simple designs and non-parametric statistical procedures. Prerequisite: None. 1 unit. (2) Section B is directed toward the professional researcher in education, and emphasizes more sophisticated and controlled research designs with implications for appropriate statistical analysis. Prerequisite: Educational Psychology 390 or equivalent, Elementary and Early Childhood Education 493A, or consent of instructor. 1 unit. Sections A and B may not be taken concurrently, but credit may be received for each.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

ENGINEERING

Program Administrator: Professor H. L. Wakeland

Program Office: 207 Engineering Hall, Urbana

100. **Engineering Lecture.** Engineering lecture for freshmen; selected topics each week. Required of freshmen in the College of Engineering. 0 credit.
101. **Cooperative Engineering Education Seminar.** Discussion seminar which gives an introduction to cooperative engineering education. Topics discussed include duties and responsibilities of the student; duties and responsibilities of the cooperative employer; and techniques for obtaining maximum benefits from the program. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.
102. **Cooperative Engineering Education Practice.** Off-campus practice of engineering in government or industry. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Engineering Lecture.** Required of off-campus transfer students in the College of Engineering. Meets for first three weeks of each semester; selected topics. 0 credit.
299. **Engineering Study Abroad.** Provides campus credit for foreign study and/or provides a mechanism for engineering students to maintain continuous enrollment on this campus. If objective is study abroad for credit, a detailed proposal must be submitted by the student for approval by a committee of the department in which the student is studying and the college office prior to such study abroad. Final determination of credit and its application toward the student's degree is made after a review of the student's work abroad by the above committee and the college office. Prerequisite: Completion of sophomore year in engineering; approval of student's proposed study program by his department and the college office. 0 to 15 hours (summer session, 0 to 7 1/2 hours).

ENGINEERING HONORS

Executive Secretary of Program: Professor R. W. Bokenkamp

Program Office: 207 Engineering Hall, Urbana

196. **The Engineer and Society.** Prerequisite: Freshman James Scholar. 2 hours.
197. **The Engineer and His Profession.** Introduction to the nature of science and engineering, and the attributes of a scientist and an engineer. Prerequisite: Freshman James Scholar. 1 hour.
198. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester for freshman James Scholars to enable them to explore at their own level various aspects of technology that are of interest to them. Prerequisite: Honors student in the University. 1 to 4 hours.
297. **College Honors Seminar.** Special lecture sequences and/or discussion groups arranged each semester in special interdisciplinary subjects of current interest for James Scholars in engineering. Prerequisite: James Scholar in engineering or consent of instructor. 1 to 4 hours.

ENGLISH

(See Humanities, School of)

ENGLISH AS A SECOND LANGUAGE

Acting Director of Division: Professor L. F. Bouton

Division Office: 3070 Foreign Languages Building, Urbana

109. **English as a Second Language.** Intensive course in basic English structure for foreign students who are inadequately prepared for either English as a Second Language 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test. 0 credit.
110. **English as a Second Language.** Study of the sounds and intonation patterns of American English and the relation of sound to spelling; designed to improve the student's ability to speak and understand English at normal conversational speed. May also be taken with English as a Second Language 111 and 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test, or consent of instructor. 0 credit.
111. **English as a Second Language.** Continuation of English as a Second Language 109. Rapid and intensive review of basic English structure and a study of more complicated sentence patterns with practice in simple oral and written composition. Designed for students inadequately prepared for English as a Second Language 114. Prerequisite: English as a Second Language 109 or recommendation from Illinois placement test, or consent of instructor. 0 credit.
114. **English as a Second Language.** Composition for undergraduate students whose native language is not English. Prerequisite: English as a Second Language 111, recommendation from overseas test or Illinois placement test, or consent of instructor. 3 hours.
115. **English as a Second Language.** Composition for undergraduate students whose native language is not English. Prerequisite: English as a Second Language 114 or equivalent, recommendation from Illinois placement test, or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
301. **Topics in Applied TESL/TEFL Theory.** Implications of TESL/TEFL theory and research for classroom practice; preparation of teaching and testing materials; evaluation of materials on the basis of ESL/EFL teaching experiences; adaptation to needs of different learner ages, language, and achievement backgrounds; and new teaching formats. May be repeated as topic changes. Not more than 1 ½ units may be counted toward the MATESL degree. Prerequisite: Consent of instructor. 1 to 2 hours, or ¼ to ½ unit.
302. **Descriptive English Grammar.** Same as English 302. 3 hours or 1 unit.
305. **Introduction to Applied Linguistics.** Same as Linguistics 305. Introduction to the applications of general linguistic theory to the specific fields of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign and second languages; practical assignment work. Prerequisite: Consent of instructor. 3 hours, or ½ or 1 unit.
350. **Sociolinguistics.** Same as Linguistics 350. Critical study of the sociologically oriented general linguistic theories; special reference to language varieties, language attitudes, language diversity, language standardization, linguistic geography, and language and political roles (language loyalty); emphasis on research methodology and techniques. Prerequisite: Introductory course in linguistics or consent of instructor. 3 hours, or ½ or 1 unit.

360. **Principles of Language Testing.** Examines purposes and uses of various types of language tests and relates them to language teaching goals; discusses testing practices and procedures related to language teaching; and includes writing objectives, item writing, basic descriptive statistics, analysis, and test administration. A project is required. 2 hours or $\frac{1}{2}$ unit.
371. **Teaching Composition in the ESL Classroom.** Applies psycholinguistic and pedagogical principles to the teaching of writing/composition in the ESL situation at all levels; examines current approaches and techniques and relates them to teaching goals, student needs, and a variety of teaching situations. Projects require the evaluation, adaptation, and construction of composition teaching materials. 2 hours or $\frac{1}{2}$ unit.
382. **Language Laboratory Techniques.** Same as Classical Civilization, French, German, Humanities, Slavic, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
388. **Linguistics in Language Learning, I.** Same as Linguistics 388. Application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
389. **Linguistics in Language Learning, II.** Same as Linguistics 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the applications of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Verbal Communication in English as a Second Language for Graduate Foreign Students, I.** Language laboratory course concentrating on the typical writing problems that a graduate or research student encounters in an American university. Prerequisite: Graduate standing and English as a Second Language 111, or consent of instructor. 0 to 4 hours. No graduate credit.
401. **Verbal Communication in English as a Second Language for Graduate Foreign Students, II.** Language laboratory course dealing with individual, immediate, and specialized speaking and writing problems, with particular attention to orienting graduate or research students to the techniques of the American university in thesis and other specialized writing, and in the oral presentation of such material. Prerequisite: Graduate standing and English as a Second Language 400, or consent of instructor. 0 to 4 hours. No graduate credit.
402. **Introduction to General Linguistics.** Same as Anthropology and Linguistics 400. Introduction to the linguistic sciences; linguistic theory and methodology; and branches of linguistics and their application. 1 unit. Credit may not be applied toward a graduate degree in linguistics.
410. **Generative Phonology in English Teaching.** Generative phonological analyses of English and the teaching of English pronunciation: reevaluation of teaching goals, content, presentation, and methodology; required projects involve developing and evaluating lesson materials and observing and participating in teaching generative materials in ESL classes. Prerequisite: English as a Second Language 301 and English as a Second Language/Linguistics 388. 1 unit.
419. **Contrastive Linguistics.** Same as Linguistics 419. Critical survey of contemporary linguistic models with special reference to their relevance in preparing contrastive analyses of languages; detailed discussion on contrastive analyses of English and selected non-Western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. $\frac{1}{2}$ or 1 unit.
463. **College Teaching of Foreign Languages.** Same as French, Russian, German, and Spanish 463. Rationale for curricular objectives for college courses in foreign language-

es; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.

481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, German, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Consent of instructor. 1 unit.
487. **Seminar in the Teaching of English as a Second Language.** Discussion of and research into various topics of current interest to persons involved in teaching English as a second language; emphasis on new approaches to problems facing the field and the development of understanding methods; and study of materials leading to possible solutions. May be repeated as the topic changes. Prerequisite: English as a Second Language 388 or 302, or consent of instructor. $\frac{1}{2}$ to 1 unit.
491. **Research in Special Topics.** Independent study under guidance of a member of the graduate faculty. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated for a total of 2 units.

ENTOMOLOGY

(See Life Sciences)

ENVIRONMENTAL STUDIES

Director of Institute: Professor B. B. Ewing

Institute Office: 911 West High Street, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
236. **Tomorrow's Environment.** Same as Health Education 236. Introduction to the environmental problems of a finite world; temporal perspective on impacts on the natural ecosystem and the resulting limits on growth; and projections of environmental conditions based upon understanding relevant natural systems and human impacts under alternative management strategies. Prerequisite: One course in the life sciences and one course in the social sciences, or consent of instructor. 3 hours.
299. **Individual Studies of Environmental Topics.** Individual studies of environmental problems and their solutions. Studies are accomplished under the immediate supervision of faculty of the Institute for Environmental Studies. Prerequisite: Consent of instructor. 0 to 4 hours.
319. **Environment and Plant Ecosystems.** Same as Agronomy and Forestry 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processing; discussion of physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels. Prerequisite: One course in biology, Chemistry 101 or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
348. **The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, General Engineering, Geography, Mechanical Engineering, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In

Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.

374. **General Epidemiology.** Same as Health Education, Medical Sciences, Veterinary Medical Science, and Veterinary Pathology and Hygiene 374. The epidemiology and natural history of infectious and noninfectious diseases, including integrated vector control and host resistance, and mental health and public health. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent, or consent of instructor. 4 hours or 1 unit.
393. **Environmental Quality Management.** Same as Urban Planning 393. Issues and concepts used in determining the desired level of environmental quality, with emphasis on pollution control; comparisons of management alternatives with emphasis on equity, cost, and ease of administration; and includes the study of an actual pollution management problem. Designed for students with an environmental or public policy analysis background. Prerequisite: Senior or graduate standing; calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
397. **Selected Environmental Problems.** Advanced study of problems related to the environment. Each unit of instruction focuses on a coherent problem area centered primarily within the subject matter of one or more interrelated disciplines comprising the Institute and taught by one or more faculty members from these disciplines. Prerequisite: Senior or graduate standing and consent of instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
495. **Environmental Studies Seminar.** Interdisciplinary seminar on topics of current interest. Students, faculty, and visiting lecturers present seminars based upon their study, research, and/or professional activities in the selected environmental topic area. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated as topic varies.
497. **Studies of Environmental Topics.** Individual or group research and study of environmental topics. Subjects for individual study, selected by the student, must be approved by the student's adviser and by the Director of the Institute. (Note: This is not a thesis research course.) Group study focuses on environmental problems and their solutions. Prerequisite: Consent of instructor. 0 to 4 units. May be repeated.

FINANCE

Head of Department: Professor J. W. Leonard

Department Office: 340 Commerce Building (West), Urbana

150. **Money, Credit, and Banking.** Study of monetary and banking systems and the impact of monetary policy on employment, prices, economic growth, and international trade. Prerequisite: Economics 101 or equivalent. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
230. **Investment Principles.** Financial investment as promoter of economic productivity; securities: government, corporate, and mutual fund; securities markets: exchanges, brokers, and dealers; investment decisions in theory and practice; elements of security analysis and portfolio management; and the special case of mutual funds and their shares. Prerequisite: Economics 101 or equivalent. 3 hours.
235. **Investment Management.** Application of investment theory, analysis, and valuation methods to practical problems of investment management; selected cases and problems. Prerequisite: Finance 230 and 254. 3 hours.
252. **Banking Practice in the United States.** Study of the functions, operations, policies, or-

- ganization, management, and supervision of banks. Prerequisite: Finance 150 and 254. 3 hours.
253. **Investment Banking.** Role of investment banking in the financial organization; investment banking houses; relation of investment banking to other financial institutions; regulation of investment banking and the security markets; and current problems and developments in investment banking. Prerequisite: Finance 150 and 254. 3 hours.
254. **Introduction to Business Financial Management.** Development and study of a decision framework for financial management; an introduction to the analysis of past and future needs; an analysis of the management of short-term assets; an introduction to a decision framework for capital investment management with an analysis of the cost and sources of long-term capital; and integration of the concepts of financial management into a total systems approach to business decision making. Prerequisite: Accountancy 105 or 201; credit or concurrent registration in Economics 172. 3 hours. Credit is not given for both Finance 254 and 257.
255. **Financing Corporate Consolidation and Reorganization.** Financial aspects of industrial concentration; the combination movement; financing complex corporate enterprises; financial phases of reorganization; and the reorganization process. Prerequisite: Finance 254 or 257. 3 hours.
257. **Corporation Finance.** Study of the character of corporations; corporate securities; acquiring capital; internal financial control; expansion and intercorporate relations; and corporate capital readjustments. For noncommerce students only. Prerequisite: Economics 101 or equivalent. 3 hours. Credit is not given for both Finance 257 and 254.
258. **The Money Market and American Financial Institutions.** Study of the development and the practices of specialized financial institutions in the United States: commercial banking; central banking; savings banks; trust companies; investment banking; real estate finance; agricultural finance; and government financial institutions. Prerequisite: Economics 101 or equivalent. 3 hours.
260. **Economics of Insurance.** Survey course in insurance which serves as a common introductory course to the fire, marine, casualty, surety, and life branches of the insurance business. Prerequisite: Economics 101 or equivalent. 3 hours.
262. **Life Insurance.** Study of the life insurance industry, companies, products, and markets. Prerequisite: Economics 101 or equivalent. 3 hours.
280. **Advanced Financial Management.** Integration of the capital investment, long-run financing working-capital decision processes; use of simulation, cases, and other techniques to study each decision process. Prerequisite: Finance 254. 3 hours.
294. **Senior Research.** Research and reading course for students concentrating in finance, insurance, urban land economics, or related areas who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better; (2) have attained Honors Day recognition in the junior year; or (3) have consent of instructor. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
295. **Senior Research.** Research and reading course for students concentrating in finance, insurance, urban land economics, or related areas who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better; (2) have attained Honors Day recognition in the junior year; or (3) have consent of instructor. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.
340. **Consumer Finance.** Nature and importance of consumer finance; trends in consumer credit; instruments and institutions of consumer credit; economic effects of consumer finance; and consumer credit and public policy. Prerequisite: Finance 150 and 254; or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
357. **Financing Small Business.** Size and nature of small business; significance and limitations of small business; financial structure and problems; financial assistance to small business; and future prospects of small business. Prerequisite: Finance 254 or 257. 3 hours, or $\frac{1}{2}$ or 1 unit.

360. **Employee Benefit Plans.** Same as Labor and Industrial Relations 360. Analysis of the economic and financial issues involved in designing and administering employee benefit plans; major emphasis on group life, disability income, and medical care plans, and on qualified pensions and profit-sharing plans for regular employees; and some attention to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Business Administration 351, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
363. **Seminar in Life and Health Insurance.** Seminar devoted to discussions of current financial, legal, and social problems involving life and health insurance; discussion of legal and financial problems involving life and health insurance product development, life and health insurance in estate planning, government regulation of the life insurance industry, and the economic aspects of the industry. 3 hours, or $\frac{1}{2}$ to 1 unit.
364. **Fundamentals of Real Estate and Urban Economics.** Determinants of growth and development; survey of problems affecting land resource allocation: transportation, poverty, employment, public finance, and housing; introduction to systems analysis, cost-benefit, and cost-effectiveness studies, real estate market forecasting, appraising, economic base analysis, financing, construction, and land-use controls. Prerequisite: Six hours of economics and a course in political science or sociology, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
365. **Urban Land Investment Analysis.** Provides an analysis on framework for urban real estate investment decisions by individuals and institutions; exposition of rate-of-return analysis illustrated by actual investment situations. The determinants of real estate investment policy for borrowers and lenders require consideration of mortgage markets, government policies, risk controls, and analysis of different types of real estate investments. Prerequisite: Finance 364 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
366. **Valuation Theory and Methods.** Concentration on land value theory and methods; primary concern on the selection of a valuation theory which produces an ethical valuation as needed by buyers, sellers, lenders, the government, insurers, etc.; examination of the role of the appraiser as evaluator, expert witness, and counselor; and use of case method to demonstrate principles and practices. Prerequisite: Finance 364 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
367. **The Urban Public Economy.** Same as Economics 361. Economic analysis of public policy with respect to urban problems; a full development of externalities at the core of the urban economy; the theory of local public finance, pricing, and investment decisions in the urban public sector; and the application of cost-benefit analysis and user charge pricing to such problems as housing, transportation, land-use controls, pollution, poverty, and education. Prerequisite: Economics 360 or Finance 364. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Risks and Risk Management.** Analysis of the financial problems in the risks of property damage or bodily injury (in business situations), and evaluation of the alternative methods for dealing with such problems. Prerequisite: One of the following: Accountancy 105 or 201, or Finance 254 or 257; Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
371. **Seminar in Property and Liability Insurance.** Seminar devoted to discussions of current financial, legal, and social problems involving property-liability insurance; analysis of legal problems involving insurance coverages, financial aspects, and governmental regulation of the property-liability insurance enterprise, and economic aspects of the insurance industry. 3 hours, or $\frac{1}{2}$ to 1 unit.
420. **Central Banking Policy.** Examination of modern theories of monetary management, gold standard theories, central banking, fiscal policy, debt management, and their relation to monetary policy. 1 unit.
425. **The Money Market and Financial Stabilization.** Study of interest rate determination; the structure and operations of the money and capital markets; and the objectives and implementation of monetary, fiscal, and debt management policies. Prerequisite: Finance 150. 1 unit.

427. **Research Seminar in Banking.** Research reported and explored in areas of commercial bank models and behavior, bank structure and regulation, and central bank control; current topics, specialized areas in banking, and research procedures are discussed by instructor, students, and guest lecturers. Prerequisite: One semester of graduate economic theory; Economics 470. 1 unit.
452. **Long-Term Financial Decision Making.** Same as Business Administration 452. An analytical approach to the theoretical and applied aspects of decision making in business finance; assumes a long-term planning horizon; and emphasizes valuation and cost of capital theories, capital investment decisions, risk analysis, and capital structure and dividend policies. Prerequisite: Finance 254 or Business Administration 451, or equivalent; Economics 470, Business Administration 472, or concurrent registration in either course. 1 unit.
453. **Working Capital Management.** Same as Business Administration 453. A study of working capital management processes and of theoretical linkages between working capital and long-run financial management; uses a variety of models to study the theory of working capital management and to analyze relationships among variables in the short-run financial decision-making process; and combines theory and applications to provide insight into the total financial decision-making process. Prerequisite: Finance 254 or Business Administration 451, or equivalent; Economics 470, Business Administration 472, or concurrent registration in either course. 1 unit.
454. **Corporation Finance.** Nature of corporation finance and its relation to economics, accounting, and law; development of business corporation; concepts of capital, capitalization, and capital stock; nature of equities in corporation; financial analysis and interpretation; nature and development of financial plans; corporate securities and their adaptation to financial plan; initial and promotional financing; current capital financing; income administration; and refinancing. Prerequisite: Finance 254. 1 unit.
455. **Seminar in Finance.** Philosophy of research; critical evaluation of selected research; emphasis on empirical studies; evaluation of analytical methods employed; relation of research questions to research methods; and development of thesis research topics. Prerequisite: Finance 453 or 458. 1 unit.
456. **Investment.** Study of the financial process by which savings are transformed into capital; theories of investment value and of portfolio composition; critique of individual and institutional portfolio policies; and survey of investment literature. 1 unit.
457. **Security Analysis and Investment Management.** Same as Business Administration 457. Application of decision theory and quantitative methods to problems of individual security valuation and selection, portfolio composition, and investment management. Prerequisite: Finance 254 or equivalent, or Business Administration 451 or equivalent. 1 unit.
458. **Portfolio Theory.** Same as Business Administration 458. Theoretical and research-oriented course related to the problems of efficient allocations of resources in security portfolios of large financial institutions; integration of interdisciplinary problems such as capital market price behavior and stock price behavior with portfolio analysis models. Prerequisite: Finance 457 or equivalent. 1 unit.
460. **Theory of Insurance.** Study of the nature and cost of risk in our economic society, and of the methods of handling it. 1 unit.
468. **Studies in Urban Economics: Environment and Land Use.** Economic forces and policies affecting location, growth, and economic base of the city; consideration of problems affecting urban resource allocation and location: housing, transportation, ecology, segregation, public finance, and strategies in community development; and consideration of theories and methods of analysis of effective urban resource allocation and valuation. Graduate students should consult with the instructor as to whether Finance 364 or this course is preferable. 1 unit.
469. **Problems and Policies in Urban Economics.** Urban development and the national economy; interaction of business institutions and public agencies in performance of urban functions; determinants of land-use patterns; economic aspects of property rights

and land-use controls; and unmet needs. Students undertake intensive analysis problem selected for individual study; cooperation with urban planning, architecture, landscape architecture, and other departments. Prerequisite: Finance 364 or 468, or consent of instructor. 1 unit.

470. **Risk Management and Control.** Same as Business Administration 455. Analysis of the risk management problem in the business enterprise with emphasis on methodology for risk analyses; techniques for risk and loss control; models for risk management decision making; and procedures for administering risk management policy relating to nonspeculative (insurable) risk. Prerequisite: Finance 452 and Business Administration 460, or equivalent, or consent of instructor. 1 unit.
490. **Individual Study and Research.** Directed reading and research. $\frac{1}{2}$ to 1 unit.
499. **Thesis Research.** Required for those writing master's and doctoral theses in finance. 0 to 4 units.

FINE AND APPLIED ARTS

Program Administrator: Professor J. H. McKenzie
Program Office: 114 Architecture Building, Urbana

101. **Language and Design, II.** 0 to 6 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
299. **FAA Study Abroad.** Provides campus credit for foreign study and/or travel. A detailed proposal for study abroad must be submitted for approval by the appropriate committee of the department in which the student is studying and the college dean's office prior to such study abroad. Final determination of credit and its application toward the degree is made after a review of the student's work abroad by the above committee and college office. Prerequisite: Junior standing in the department; approval of the student's proposal by the departmental committee and the college office. 0 to 12 hours (summer session, 0 to 6 hours).

FOOD SCIENCE

Head of Department: Professor A. J. Siedler
Department Office: 567 Bevier Hall, Urbana

101. **Food in Modern Society.** Emphasis on the importance of food in providing adequate nutrients for modern society; introduction to processing and preservation of foods as well as the historical, geographical, chemical, and microbiological ramifications which exist in the food industry. 3 hours.
202. **Sensory Evaluation of Foods.** The physiology, psychology, and chemistry of flavor and flavor perception; tactual, visual, and auditory components affecting food acceptability; principles and application of preference and discrimination testing; and interpretation of panel evaluation data. 3 hours.
206. **Field Trip.** Inspection of typical food preservation and manufacturing plants. Four-day trip required of all seniors in food science and food industry; see *Timetable* for current fees. Prerequisite: Junior standing in food science or consent of instructor. 1 hour.
213. **Food Analysis, I.** Principles and application of the chemical methods used to determine the major and minor constituents of foods; physical measurements applied to foods;

- and special considerations applicable to the analysis of certain foods. Prerequisite: Chemistry 102. 3 hours.
214. **Survey of Food Chemistry.** Chemical composition of foods and the chemistry of the processing of meats, vegetables, fruits, milk, and cereals. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 102. 3 hours.
260. **Raw Materials for Processing.** Lectures, reference readings, and laboratory experiments concerning the problems involved with procurement, harvesting, handling, and storage of fruits, vegetables, cereal grains, dairy products, and meat for the food-processing industry. Field trips to specialized operations. Prerequisite: One course in biological science and Food Science 101, or consent of instructor. 4 hours.
300. **Special Problems.** Supervised research on special problems in food science. Prerequisite: Written consent of instructor must be obtained prior to enrollment. Not open to undergraduates who are on probation. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{3}{4}$ to 1 $\frac{1}{2}$ units. May be repeated to a maximum of 2 units.
301. **Food Processing.** Principles and application involved in canning, freezing, dehydrating, flour milling, luncheon meats, freeze drying, and plastic films. Field trips to food processing and manufacturing operations. Prerequisite: Food Science 202, 213, or 260, or consent of instructor. 5 hours or 1 $\frac{1}{4}$ units.
308. **Food Plant Management.** Problems in product development, organization, financing, labor management, and operation of food plants. Prerequisite: Senior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
310. **Dairy Product Processing.** Theory and practice in procurement of milk, separation and creaming phenomena, homogenization, and heat treatment; concentrating, drying, and freezing as applied to fluid milk products, cultured milk products, concentrated and dried milk products, ice cream, butter, and cheese. Prerequisite: Food Science 213 and 260, or consent of instructor. 5 hours or 1 $\frac{1}{4}$ units.
313. **Food Analysis, II.** Laboratory exercises, demonstrations, and assigned readings dealing with the application of analytical chemical and instrumental techniques to the analysis of food constituents. Prerequisite: Food Science 213 or equivalent, such as quantitative analysis. 4 hours or 1 unit.
314. **Food Chemistry, I.** Major chemical components of foods, lipids, carbohydrates, and proteins, and the chemical changes that occur during processing and storage. Credit is not given for both Food Science 214 and 314. Prerequisite: Chemistry 131 and 134. 3 hours or $\frac{3}{4}$ unit.
315. **Food Chemistry, II.** Minor chemical components of food: vitamins, pigments, salts, trace elements, and enzymes, and the changes that occur in them during processing and storage; the physical and colloidal properties of foods; food additives and contaminants; and metabolism of foods. Prerequisite: Food Science 314. 3 hours or $\frac{3}{4}$ unit.
320. **Nutrition in Food Science.** The nutritional requirements of man with emphasis on nutritional considerations in the industrial production of food. Prerequisite: Food Science 315 or a course in general biochemistry. 3 hours or $\frac{3}{4}$ unit.
324. **Biochemical Aspects of Human Nutrition.** Same as Home Economics 324. Advanced treatment of human nutrition, with emphasis on the biochemical functions of nutrients essential for man. Prerequisite: Biochemistry 350, Biochemistry 352 and 353 and a course in nutrition, or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Students may not receive credit for Food Science/Home Economics 324 and Food Science 320.
332. **Principles of Sanitation in the Processing and Handling of Foods.** Study of the principles of sanitation with appropriate emphasis on practical considerations as they apply to various food-processing industries; control of insects, rodents, and micro-organisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods; and government and public health regulations. Field trips to local food-processing plants. Prerequisite: Microbiology 100 and 101; Chemistry 102. 2 hours or $\frac{1}{2}$ unit.

- 340. Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
- 363. Introduction to Process Engineering.** Fundamentals of heat transfer, fluid flow, evaporation, drying, and other unit operations in the process industries. Prerequisite: Calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 373. Advanced Food Microbiology.** Fundamentals of those food and industrial processes which are dependent on fermentation or other microbial activities. Prerequisite: Chemistry 131, Microbiology 311, and a course in calculus. 3 hours or $\frac{3}{4}$ unit.
- 391. The Chemistry of Lipids in Foods.** Detailed survey of the chemical and physical properties of lipids. Prerequisite: Biochemistry 350 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 401. Physical Chemical and Colloidal Phenomena of Food Products.** Study of physical, chemical, and colloidal phenomena involved in the processing of food products including such topics as food emulsion, foams, gelation, coagulation, rheology, and membrane phenomena in foods. Prerequisite: Chemistry 340. 1 unit.
- 406. State and Metabolism of Lipids.** Advanced study of the state of lipids in animal tissues and in biological fluids, and of the metabolism of lipids in relation to dietary fats and other food constituents. Prerequisite: Biochemistry 350 or consent of instructor. 1 unit.
- 410. Current Topics in Nutritional Research.** Same as Dairy Science and Nutritional Sciences 410. Discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. $\frac{3}{4}$ unit.
- 411. Chemistry of Nutritional Processes.** Same as Dairy Science and Nutritional Sciences 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. 1 unit.
- 421. Seminar.** Discussions on specialized topics and current literature relating to food technology. Required of all graduate students in food science. $\frac{1}{4}$ unit.
- 440. Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Food Science 340 or equivalent. $\frac{3}{4}$ unit.
- 481. Advanced Special Problems in Food Science.** Supervised individual study on advanced special problems in food science. Prerequisite: Written consent of instructor must be obtained prior to enrollment. $\frac{1}{2}$ to 2 units (summer session: $\frac{1}{2}$ to 1 unit).
- 499. Thesis Research.** 0 to 4 units.

FORESTRY

Head of Department: Professor I. I. Holland

Department Office: 211 Mumford Hall, Urbana

- 100. Farm Forestry.** Designed for nonforestry majors. General aspects of forestry in Illinois, including tree identification, map interpretation, timber management, measurement and utilization, harvesting methods, reforestation and protection, and management for

- nontimber uses. Prerequisite: Enrollment in College of Agriculture or College of Education, or consent of instructor. 3 hours.
101. **General Forestry.** The forest as a renewable natural resource; the aims and scope of forestry; economic and social importance of forests to the nation; the principal forest regions and species; forests for timber supply, for water conservation, for recreation, and for wildlife; the principles of forest management and protection; the development of public and private forestry in the United States; and forestry as a profession. Prerequisite: Enrollment in a forestry curriculum or sophomore standing. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Special Problems.** Supervised research on special problems in forestry. Prerequisite: A minimum grade-point average of 3.75; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 3 hours.
201. **Wildland Recreation (Summer Field Studies).** Field study of wildland recreational resources and facilities, user characteristics and preferences, and management techniques within the multiple-use concept. Prerequisite: Competence in the courses prescribed in the first two years of the forest science curriculum. 1 hour.
211. **Forest Ecology (Summer Field Studies).** Introduction to forest ecology and the application of ecological principles in silviculture and management practices. Prerequisite: Competence in the courses prescribed in the first two years of the forest science curriculum. 2 hours.
213. **Silviculture.** The art and science of controlling forest establishment, composition, and growth that will best fulfill the objectives of the owner. Prerequisite: Forestry 211. 3 hours.
220. **Dendrology.** Taxonomy, geographical distribution, economic importance, and elementary silvics of the important forest trees in the United States and Canada. Prerequisite: Botany 100. 4 hours.
221. **Forest Measurements (Summer Field Studies).** Introduction to forest measurements, including individual tree and stand measurements, inventory methods, and determination of the growth of trees and stands; topics in surveying and aerial photogrammetry. Prerequisite: Competence in the courses prescribed in the first two years of the forest science curriculum. 2 hours.
231. **Wood Utilization, I (Summer Field Studies).** Field and classroom exercises in logging and milling, conversion of raw wood to useful products, visits to plants, and industrial aspects of wood use. Prerequisite: Competence in the courses prescribed in the first two years of the forest science curriculum. 1 hour.
232. **Wood Utilization, II.** Principles and methods of harvesting, grading, and transporting forest products; conversion of logs, bolts, and cordwood; physical-mechanical properties and defects of wood; and specifications and uses of lumber, veneer, plywoods, pulp, paper, and chemical derivatives. Prerequisite: Forestry 231. 3 hours.
236. **Physical Properties of Wood and Wood-Base Materials.** Physical properties of wood materials, emphasizing the influence of anatomy, density, and moisture content; wood-liquid relations; thermal, electrical, and acoustical properties; and study of the theory and practice of wood seasoning for determining dimensional stability. Prerequisite: One year of college physics and one year of college chemistry, or consent of instructor. 3 hours.
242. **Forest Resources Management.** Concepts, techniques, and management tools applied to forest properties managed for continuous production of timber and other forest products; determination of optimum rotation and growing stock; and appraisals, taxation, and management planning. Prerequisite: Senior standing. 4 hours.
253. **Forest Economics.** Concepts of economic supply of, and demand for, the major wood products; trends in wood products consumption and prices, and the major marketing

problems; and prospects for future development of U.S. wood products industries and trade. Prerequisite: Economics 101 or equivalent. 3 hours.

256. **Surveying Agricultural and Forest Lands.** Same as Agricultural Engineering 256. Basic surveying procedures as applied to practices in soil and water conservation engineering and forest management and engineering. Prerequisite: Mathematics 114. 2 hours.
260. **Forest Land Policy and Administration.** Forest land policies and their administration with emphasis on the relations among resources, politics, and people; current major problems in forest land policy administration and progress toward their solution. Prerequisite: Economics 101 or consent of instructor. 3 hours.
271. **Wood Anatomy and Identification.** Study of the macroscopic, microscopic, and ultra-microscopic structure of wood and the identification of many important commercial woods by means of anatomical characteristics; fundamental physical and chemical properties of wood. Prerequisite: Enrollment in forest science or wood science curricula, or consent of instructor. 3 hours.
273. **Adhesives and Laminates.** Physical and chemical properties of the principal adhesives used to bond wood and other materials; principles of adhesion; and manufacture, properties, and uses of plywood, laminated wood, and other products. Prerequisite: Enrollment in the wood science curriculum or consent of instructor. 3 hours.
274. **Wood Preservation.** Theory and application of wood preservation; agencies causing deterioration of wood and their control; and fire retardants, treating chemicals, and processes. 3 hours.
275. **Seminar in Wood Science.** Individual problems in the field of wood technology and utilization chosen by the student. Each problem involves library studies, verbal reporting, and group discussion. Prerequisite: Junior standing in the wood technology and utilization curriculum. 2 hours.
278. **Aerial Photointerpretation.** Same as Geography 278. Introduction to the analysis and interpretation of aerial photographs; emphasizes applications to the inventory and management of natural resources and land use planning. 2 hours.
281. **Introduction to Forest Resource Management (Summer Field Studies).** Field introduction to forest resource management, including wildlife management, watershed management, and forest protection. Prerequisite: Competence in the courses prescribed in the first two years of the forest science curriculum. 2 hours.
304. **Forest Pathology.** Same as Plant Pathology 304. Principles of forest and shade-tree diseases; symptoms, causal agents, and control of major tree diseases and wood decays; and the role of man in creating and solving disease problems. Prerequisite: Botany 100 or equivalent. 3 hours or $\frac{3}{4}$ unit.
315. **Forest Soils.** Study of the physical, chemical, and biological properties of forest soils; includes the relationship of forest soils to the total environment, forest hydrology, tree growth, and stand development; weekend overnight field trip required. Prerequisite: Agronomy 101. 2 hours or $\frac{1}{2}$ unit.
316. **Advanced Forest Ecology.** Emphasizes the relationship between environmental factors and tree growth; discusses various silvicultural and site-improvement practices in relation to their ecological basis; weekend overnight field trip required. Prerequisite: Forestry 211 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
319. **Environment and Plant Ecosystems.** Same as Agronomy and Environmental Studies 319. Man's role in environmental regulation and how it affects crop productivity through altered cellular and organismal processes; discussion of physiological processes involved in managed plant ecosystems of the community, organismal, and molecular levels. Prerequisite: One course in biology, Chemistry 101 or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
321. **Forest Biometrics.** Introduction to statistical methods used in the management of natural resources; includes applied regression analysis and survey of sampling methods, with computer applications. Prerequisite: A course in statistics. 3 hours or $\frac{3}{4}$ unit.
324. **Decision Models in Forestry and Wood Sciences.** Introduction to models used in managerial decision making; application of operations research models to problems in for-

- est management and wood processing, with emphasis on linear programming and simulation. Prerequisite: One course in statistics. 3 hours or $\frac{3}{4}$ unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and to the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
362. **Forest Entomology.** Study of the characteristics, life histories, and forest relationships and controls of the economically important forest insects of the United States. Prerequisite: One year of biological science and one year of chemistry. 3 hours or $\frac{3}{4}$ unit.
372. **Mechanical Properties of Wood and Wood-Base Materials.** Static mechanics, strength properties, and structural designs of wood, plywood, particleboard, and hardboard, emphasizing the standard methods of testing wood and fibrous material, wood beam and column designing, and other factors concerning the strength of wood materials, particularly the derivation of allowable stresses. Prerequisite: Forestry 236, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Seminar.** Discussions on specialized topics and current literature in forestry. Required of all graduate students in forestry. $\frac{1}{4}$ unit. May be repeated to a maximum of $\frac{1}{2}$ unit.
401. **Special Problems.** Individual studies or investigations in selected branches of forestry. 0 to 1 unit. Not more than 2 units may be offered toward an M.S. degree.
414. **Discussions in Forest Ecology and Physiology.** Individual and group discussions of developments and techniques in forest ecology and physiology based on classic and current literature. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated to a maximum of 1 unit.
431. **Plant Cell Metabolism.** Same as Agronomy, Biology, Horticulture, and Plant Pathology 431. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the biochemistry of mature seeds and metabolic processes occurring during seed germination and heterotrophic growth. Meets during the first half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
432. **Plant Cell Energetics.** Same as Agronomy, Biology, Horticulture, and Plant Pathology 432. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the energy coupling processes in plant cells (respiration, photosynthesis, photorespiration); and discusses current literature relating to mechanisms of electron transport, phosphorylation, and carbon fixation. Meets during the second half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
433. **Environmental Regulation of Plant Growth.** Same as Agronomy, Biology, Horticulture, and Plant Pathology 433. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns mechanisms of plant response to the environment, including ion uptake and transport, water relationships, gas exchange, and photosynthesis of whole plants. Meets during the first half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
434. **Regulation of Plant Development and Reproduction.** Same as Agronomy, Biology, Horticulture, and Plant Pathology 434. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the hormonal regulation of growth, development, and reproduction and the metabolism of seed and fruit formation. Meets during the second half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 440. Statistical methods as tools for research; consideration of the

principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, from the viewpoint of when and how to use them. Prerequisite: Forestry 340 or equivalent. $\frac{3}{4}$ unit.

- 460. Discussions in Forest Policy and Administration.** Individual and group discussions of the major relevant problems in the field of forest resources policy and administration (both public and private) based on current literature. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated to a maximum of 1 unit.
- 499. Thesis Research.** Research may be conducted in various phases of forestry; subject must be approved by departmental committee. 0 to 3 units.

FRENCH

(See Humanities, School of)

GENERAL ENGINEERING

Head of Department: Professor J. S. Dobrovolny

Department Office: 117 Transportation Building, Urbana

- 103. Engineering Graphics, I.** Integrated course in engineering graphics for all students in the College of Engineering. Freehand sketching; theory of orthographic projection and the analysis and synthesis of theoretical and practical problems involving the size, shape, and/or relative positions of common geometrical magnitudes such as points, lines, planes, and other surfaces and solids; theory of pictorial projections; basic dimensioning; and basic charts and diagrams. Credit is not given for both General Engineering 103 and General Engineering 105. 3 hours.
- 104. Engineering Project Design Methodology.** An introductory course covering the methods, techniques, and practice of engineering project design. Individual and team effort design projects are carried out from the proposal, through the development, evaluation, and report phases. Emphasis is placed upon creativity, scheduling and planning, economic factors, and communication processes. Suitable for all students with an interest in engineering and engineering administration. Prerequisite: General Engineering 103 or equivalent, or consent of instructor. 3 hours.
- 105. Elements of Drawing.** Theory, techniques, terms, symbols, and conventional practices used in making various types of projection and nonprojection drawings with instruments and freehand. For students in the aircraft maintenance curriculum. Credit is not given for both General Engineering 105 and General Engineering 103. Prerequisite: High school plane geometry. 3 hours.
- 199. Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
- 220. History of Engineering.** Survey of the major contributions of the science and art of engineering from prehistory to the present; integrates the impact of engineering with the cultural aspects of the various periods. Prerequisite: Junior standing or consent of instructor. 3 hours.
- 221. Introduction to General Engineering Design.** Fundamental concepts involved in design problems and in production methods in construction; practice in cost analysis, planning, consideration of materials, and engineering computations involved in analysis of engineering design problems. Prerequisite: General Engineering 103 and 104, or credit or concurrent registration in Theoretical and Applied Mechanics 150. 3 hours.

222. **Analysis of Dynamic Systems.** Introduction to the operational techniques used in describing the behavior of dynamic systems; elements of modeling; equilibrium and linearization; Laplace transformation techniques; system response via the transfer function; block diagrams and computer simulation; matrix operations; system response via state variables; and stability. Prerequisite: Mathematics 345; concurrent registration in Computer Science 101. 3 hours.
232. **Engineering Analysis, II.** Study of stress conditions in various engineering materials and configurations as applied to the development of design criteria. Prerequisite: Theoretical and Applied Mechanics 221. 4 hours.
241. **Component Design.** Application of principles and methods of analysis to design of basic engineering components utilizing the common engineering materials. Prerequisite: General Engineering 232; Theoretical and Applied Mechanics 224. 4 hours.
242. **Project Design.** Design of various engineering projects emphasizing the synthesis of the subject matter covered in previous courses in basic sciences, engineering sciences, analysis, engineering economics, and component design. Prerequisite: General Engineering 241 and 288. 3 hours.
282. **Introduction to Patent Law.** Survey of the U.S. Patent System, including a brief history; requirements of patentability; patent procedures; employer-employee relations; trade secrets; infringement and remedies; copyrights; trademarks; unfair competition; and antitrust considerations. 2 hours.
288. **Economic Analysis for Engineering Decision Making.** Introduction to economic and operational analysis in the engineering decision-making process; mathematics of capital budgeting, mathematical programming, systems analysis, and the application of probability and simulation to decision making. Prerequisite: Junior standing or consent of instructor. 3 hours. Students may not receive credit for both Electrical Engineering 288 and General Engineering 288.
290. **Legal Aspects of Engineering Contracts and Specifications.** Same as Civil Engineering 290. Laws governing various engineering contracts; tort law and professional liability of engineers; workmen's compensation; property law; and business and technical clauses of specifications. Credit is not given for both General Engineering 290 and 292. Prerequisite: Senior standing in architecture or engineering, or consent of instructor. 3 hours.
291. **General Engineering Seminar.** Series of lectures and discussions by department faculty and visiting professional engineers on ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. Prerequisite: Senior standing in general engineering. 0 credit.
292. **Engineering Law.** Nature and development of the legal system; legal relationships, rights and duties, and their importance in the engineering profession; and contracts, torts, agency, business transactions, and liability for defective products. Credit is not given for both General Engineering 290 or Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in engineering or architecture, or consent of instructor. 3 hours.
293. **Special Problems.** Individual investigations or studies of any phase of general engineering selected by the students and approved by the department. Prerequisite: Junior standing; consent of instructor. 0 to 4 hours.
304. **Professional Expression.** Reading and critical study of significant authors from Plato to W. H. Whyte, selected for their contributions to intellectual breadth, imagination, and perfection of style. Original projects allow coordination with seminar and other content courses, and permit the mature student to gain any needed knowledge of reports, administrative correspondence, and articles for publication. Prerequisite: Advanced or graduate standing and consent of instructor. 3 or 4 hours, or 1 unit.
330. **Industrial Standardization.** Evolution and history of standardization; local, national, and international standardization; and emphasis on standardization procedures for individual industrial establishments. Prerequisite: Junior standing or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

- 334. Introduction to Reliability Engineering.** Same as Industrial Engineering 334. Introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 238 or Mathematics 361, or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 348. The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, Environmental Studies, Geography, Mechanical Engineering, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.
- 360. Engineering Applications of Meteorological Fundamentals.** Application of the fundamentals of meteorology to engineering problems including the transport and diffusion of particulate matter, aerosols, and gases; precipitation processes and rain-out; behavior of stack effluents; and explosion debris. Prerequisite: Physics 106 and 107; Mechanical Engineering 205 and 206, or 209, or Chemistry 342 and 344, or Physics 360; senior standing in engineering or physical science. 4 hours or 1 unit.
- 393. Special Problems.** Study of advanced problems related to general engineering. Prerequisite: Senior standing and consent of instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.

GEOGRAPHY

Acting Head of Department: Professor J. D. Fellmann

Department Office: 220 Davenport Hall, Urbana

- 102. Atmospheric Environment.** Introduction to the processes responsible for the spatial variation of weather and climate with a survey of world climatic patterns. 4 hours.
- 103. Earth's Physical Systems.** Systems approach to the physical environment, including landform, soil, vegetation, and animal elements; man's role as an ecological dominant. 4 hours.
- 104. Geographic Perspectives on Human Behavior.** Individual and aggregate human spatial behavior: perception of environment, territoriality, behavior settings, prejudicial uses of space, spatial diffusion, migration, political fragmentation, and spatial patterns of social pathologies. 4 hours.
- 105. Introductory Economic Geography.** Geographic analysis of the distribution of various kinds of economic activity; an examination of the patterns resulting from man's exploitation of the world's resources; and emphasis placed on the principles governing the location of mineral, manufacturing, and commercial activities. 4 hours.
- 185. Introduction to Social Statistics.** Same as Sociology 185. First course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.
- 198. Freshman Honors Seminar.** Through discussions and research projects, the seminar is designed to provide an in-depth understanding of topics in the field of systematic or regional geography which are selected for group study. Appropriate geographic methodology is emphasized. Prerequisite: James Scholar standing or other designation as a superior student. 3 hours.

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Interaction Between Man and Nature.** Interactions between man and the ecosystem through time and across cultures, and the spatial patterns evolving from these interactions. Prerequisite: Enrollment as a participant in three-year degree study. 3 or 6 hours.
210. **Contemporary Social and Environmental Problems.** Geographic perspectives on contemporary national and international problems. Topics vary each semester and include such themes as environmental quality, food production, urban problems, and particular social and political conflicts. 3 hours.
214. **Conservation of Natural Resources.** Survey of distribution of natural resources and major forms of utilization of these resources; emphasizes consequences of utilization systems which deplete or degrade resources and systems which conserve these resources with respect to future needs of human populations. 3 hours.
223. **Geography of Anglo-America.** Occupance patterns of the United States and Canada; regions of Anglo-America; and United States and Canada in world relations. 3 hours.
271. **Spatial Analysis.** An overview of the spatial analysis (nomothetic) approach to geographic research, both physical and human; includes discussion of the scientific method, with explanations and uses of analytic geographic concepts in studying real world problems. Prerequisite: A course in geography. 4 hours.
272. **Introductory Field Geography.** Application of fundamental geographical field techniques to field mapping; develops field mapping skills, permits practical application of geographical principles, and provides a basic understanding of field procedures; and an introduction to advanced field geography for the student who later seeks an advanced degree. 5 to 8 hours.
278. **Aerial Photointerpretation.** Same as Forestry 278. Introduction to the analysis and interpretation of aerial photographs; emphasizes applications to the inventory and management of natural resources and land use planning. 2 hours.
290. **Individual Study.** Supervised independent study of special topics or regions; required for students graduating with departmental distinction. Prerequisite: At least one formal course in the topic or region of interest; consent of instructor. 2 to 4 hours. May be repeated once for credit.
296. **Seminar on the Scope and Purpose of Geography.** The nature of geography; a brief history of the discipline, and an examination of its methodology, content and emerging trends. Strongly recommended for students planning graduate work in geography. 2 hours.
303. **Advanced Physical Geography.** Systematic analysis of the basic elements of physical geography and their interaction through time and surface expression, including the modifying effects of man. Complementary to Geology 301. Prerequisite: Consent of instructor. 4 hours or 1 unit.
304. **Soil Geomorphology.** Analysis and review of the principles of soils as applied to geomorphology, archaeology, and geography; one weekend and several one-day field trips. Prerequisite: Geography 103 or equivalent, or consent of instructor. 4 hours or 1 unit.
305. **Zoogeography.** Introduction to the principles of zoogeography; the central theme explains present distribution of animals, chiefly mammals. Prerequisite: Geography 102 and 103, Geology 102, or consent of instructor. 3 hours or 1 unit.
306. **Maps and Cartobibliographical Aids.** Examination of the problems involved in the acquisitions, care, and library use of maps. Classes become familiar with the major cartobibliographical and related aids. 2 hours or ½ unit.
312. **Atmospheric Ecology.** Elementary survey of the physical causes of climate as it is observed on all scales of time and space; the climate of the world seen as process; interactions of plants, animals, and humans with the atmosphere; and selected current topics on the atmosphere and general ecoseptematics. Prerequisite: Junior standing and consent of instructor. 3 hours or 1 unit.
313. **Climates of the Continents.** Regional treatment of the climates of the world by continents. Prerequisite: Geography 102 or consent of instructor. 3 hours or ¾ unit.

314. **Regional Problems in Resource Management.** Major problems of resource utilization examined in regions where problems are most acute; emphasizes interrelationships among resource management problems, environmental consequences of resource utilization, and the problems of public policy involved in resource management. 3 hours or $\frac{3}{4}$ unit.
315. **Physical Climatology.** A survey of the basic concepts of energy balance climatology and synoptic climatology, with emphasis on the microscale and the global scale; lectures supplemented by calculations and field observations examining the effects of location and surface characteristics on determination of climate. Prerequisite: Mathematics 112, Physics 101, and Geography 102 or 312; or consent of instructor. 3 hours or 1 unit.
318. **Bioclimatology.** A quantitative treatment of mass and energy exchanges between individual organisms and the atmospheric environment; implications for modifications of microenvironments, physiological and behavioral responses, population dynamics, and geographical distribution. Prerequisite: Physics 101 and a college-level introduction to plant, animal, or human physiology; or consent of instructor. 4 hours or 1 unit.
321. **Regional Concepts of Geography.** Theories of regionalism; nature of the geographic region; unique position of regionalism in a total geographic philosophy; and regionalism in applied geography. 2 hours or $\frac{1}{2}$ unit.
323. **Geography of the North American Midwest.** The core of the North American continent; detailed analysis of the functions and patterns of the Midlands and their external relations. 3 hours or $\frac{3}{4}$ unit.
325. **Historical Geography of North America.** Changing patterns of spatial organization in the United States and Canada, circa 1400 A.D. to 1870; focus on changing landscape patterns through time, perception of relict landscapes in the present day, and contemporary preservation of historic areas. 3 hours or 1 unit.
326. **American Landscapes.** Reviews the values and technologies which underlie the structuring of the American environment; emphasizes the changing meaning of urban, suburban, small town, rural, and wilderness places in American life; and discusses the social implications of the man-made habitat. 4 hours or 1 unit.
331. **Geography of Caribbean America.** Survey of the physical elements and occupancy sequences that distinguish the geographic regions of Mexico, Central America, Panama, and the West Indies. 3 hours or $\frac{3}{4}$ unit.
332. **Geography of South America.** Regional geography of South America with emphasis on the southern hemisphere of that continent. 3 hours or $\frac{3}{4}$ unit.
342. **Geography of Europe.** Analysis of the changing social, economic, and political geography of western Europe; special consideration to population changes and labor migrations and to planning problems in the underdeveloped regions and conurbations of the continent. 3 hours or $\frac{3}{4}$ unit.
348. **The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, Environmental Studies, General Engineering, Mechanical Engineering, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.
353. **Geography of the U.S.S.R.** Physical and cultural regionalism; a survey of natural resources and patterns of human occupancy including industry, agriculture, and transportation. 3 hours or $\frac{3}{4}$ unit.
355. **Geography of Central and South Africa.** Regional geography of Africa south of the Sahara. 3 hours or $\frac{3}{4}$ unit.
357. **Geography of the Middle East and North Africa.** Regional geography of an area with limits largely defined in terms of Arab and Moslem influence or closely related cultural

- and historical circumstances; oriented around the strategic centrality of the core of the territory as the crossroads of Europe, Asia, and Africa. 3 hours or $\frac{3}{4}$ unit.
361. **Geography of Agricultural Land Utilization.** Geographic consideration of the nature of agricultural land utilization from the world, continental, and regional viewpoints; special emphasis on the geographical implications of various types of agricultural land use and upon the interrelationships between areas of different types of land utilization. 3 hours or $\frac{3}{4}$ unit.
362. **Geography of Manufacturing.** Analysis of factors bringing about geographical concentration of industry; description and analysis of each of the major manufacturing regions of the world in terms of the geographic conditions which have influenced its location and products. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
363. **Geography of Mineral Resources.** An examination of the spatial aspects of the production and use of mineral resources; concerns the adequacy of supply and the environmental and economic consequences of mineral use. 3 hours or $\frac{3}{4}$ unit.
365. **Transportation Systems and Spatial Development.** Descriptors of transportation systems; allocation models; transportation as an industrial activity and public good; and transportation and spatial development, including the role of transportation in developing countries and in urban and regional development and problems involved in measuring the impact of transport investment. 3 hours or $\frac{3}{4}$ unit.
366. **Location of Industry and Other Economic Activities.** Industrial site selection in theory and practice; examines the effect of factors such as materials, markets, labor, transportation, and environmental constraints on industrial location; and evaluates urban commercial patterns and factors affecting the location of commercial activities. 3 hours or $\frac{3}{4}$ unit.
370. **Introduction to Quantitative Methods in Geography.** Introduction to statistical, numerical, and mathematical techniques used in geographic research; introduction to computer usage in geographic research. Prerequisite: Geography 185, one year of college mathematics, or one course in statistics, or equivalent. 4 hours or 1 unit.
371. **Introduction to Research.** Introductory training in bibliographical and cartographic techniques as source materials of geographic research. Prerequisite: Geography major. 3 hours or $\frac{3}{4}$ unit.
373. **Map Compilation and Construction.** Instruction and practice in the basic techniques of map making followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed); the selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. 4 hours or 1 unit.
378. **Descriptive Interpretation of Remote Sensors.** Descriptive interpretation of remote-sensing images with emphasis on interpretation of aerial photography; applications of aerial photography and photographic interpretation to the solution of problems in the major field of the individual student. Two half-day field trips on Saturdays. 4 hours or 1 unit.
381. **Russian Culture History and Ethnology.** Same as Anthropology 381. Historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Siberian Culture History and Ethnology.** Same as Anthropology 382. Ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Urban Geography.** Distribution, functions, and internal structures of cities; a geographic analysis and classification of urban centers and their tributary areas. 3 hours or $\frac{3}{4}$ unit.
384. **Interaction in the Geographical Environment.** Human interaction in social and geographic spaces; introduction to interaction models in social geography and to mechanisms of information flow that underlie the human spatial interaction processes; and

detailed consideration of the social and spatial dimensions of individual action spaces and of theories of migration. 3 hours or 1 unit.

385. **Perception of the Geographical Environment.** Introduction to the study of environmental perception, especially the parameters of human spatial awareness; focus on proxemic behavior and human space needs, space searching and locational decisions, and symbolic value in landscape and place preferences. 3 hours or 1 unit.
386. **Political Geography.** Territorial behavior of nation-states; boundary conflicts and influences; regional voting patterns in the United States; malapportionment and gerrymandering; voting behavior of American minorities; and metropolitan fragmentation and spatial access to public services. 3 hours or $\frac{3}{4}$ unit.
403. **Physical Systems in Landform Analysis.** Same as Geology 403. A study of the phenomena of the physical landscape in terms of the basic principles of mechanics and systems theory. Prerequisite: Geography 303 or equivalent, or consent of instructor. 1 unit.
405. **Seminar in Physical Geography.** Advanced study of one of several topics that vary from semester to semester and include: (a) paleogeography; (b) climatic change; (c) landform and climate; (d) numerical analysis of landforms; (e) research philosophy of physical geography; (f) quaternary problems; (g) urban physical environments; (h) ecological aspects of climatic change; (i) contemporary problems in physical geography; (j) economic impacts of weather and weather forecasting; and (k) laboratory and field methods in soils geography. Prerequisite: Advanced course work in physical geography and consent of instructor. $\frac{1}{2}$ to 1 unit.
412. **Analytical Climatology.** Detailed consideration of the character and causes of the climates of certain selected areas; the application of various criteria as bases for climatic differentiation. Prerequisite: Geography 102; Geography 313 or equivalent; consent of instructor. 1 unit.
429. **The Evolution of Agricultural Economies.** Same as Agronomy 429 and Anthropology 429. Problems concerning the development of the several basic food crop economies are studied from the point of view of geographical environment, the available archaeological and ethnographic evidence, and agronomy and plant genetics; regional emphasis varies from year to year. Prerequisite: Consent of instructor. 1 unit.
463. **Historical Geography.** History and philosophy of historical research in geography. Research strategies for the analysis of individual and aggregate spatial behavior in the past, derived geographical patterns, changing spatial behaviors and patterns through time, and historical values underlying contemporary geographical decision making. 1 unit.
471. **Advanced Research Concepts.** Development of research strategies for geographic studies; examination of contemporary geographic theory from the standpoint of both application and policy-oriented research. Prerequisite: Geography 371. $\frac{1}{2}$ unit.
473. **Problems in Cartography.** Subjects for map presentation are selected in the student's field of specialization or area of interest. Data are collected and maps compiled and carried to completion in final drafted form suitable for publication. Prerequisite: Geography 373 or consent of instructor. 1 unit.
477. **Area Analysis.** Individual analysis of areas in the vicinity of Urbana. 1 unit.
478. **Advanced Field Geography.** Graduate course in the theory and application of geographical field techniques to the analysis of areas, culminating in individual reports on assigned problems in the field course area. Prerequisite: Graduate standing in geography. 1 $\frac{1}{4}$ to 2 units. Offered in the summer session only.
495. **Advanced Studies in Geography.** Seminar and directed individual investigation of selected problems or regions; designed to develop ability to conduct independent investigation. All students are required to register each semester in section Z (the departmental colloquium) for 0 units in addition to other 495 work which may be selected. 0 to 2 units. Scheduled seminars and staff interests and availabilities are detailed in each semester's *Timetable*.
497. **Development of Geographic Thought.** Consideration of the various philosophies of geography and of the people who reflect them. $\frac{1}{2}$ unit.

499. **Thesis Research.** 0 to 4 units.

GEOLOGY

Head of Department: Professor F. A. Donath

Department Office: 249 Natural History Building, Urbana

101. **An Introduction to the Study of the Earth.** For nonscience students; integrates all aspects of geological science into a unified theory of the evolution and continuing dynamic behavior of the earth. No more than 8 hours of credit may be received for Geology 101, 102, 107, and 108. Students may not receive credit for Geology 101 and Geology/Liberal Arts and Sciences 143. 4 hours.
102. **History of the Earth.** For nonconcentrators in geology; history of the earth from the physical and biological points of view; and methods of determining earth history. One-day field trip may be required. No more than 8 hours of credit may be received for Geology 101, 102, 107, and 108. Students may not receive credit for both Geology 102 and 103. 4 hours.
103. **History of Life.** For nonconcentrators in geology; a survey of the diversity of organisms which have populated the earth, their origin, sequence in time, ecology, and the principles used in studying them. Students may not receive credit for Geology 103, and Geology 102 or 108. Prerequisite: Geology 101. 2 hours.
104. **Geology and Society.** For nonconcentrators in geology; considers aspects of geology of most significance to man and society, such as energy and natural resources, dynamic processes, geologic hazards, land use planning, and environmental concerns. Students may not receive credit for Geology 104, and Geology 107, Geology 108, or Geology/Liberal Arts and Sciences 143. Prerequisite: Geology 101 or 102. 2 hours.
105. **Geology of Energy.** Geological factors governing or affecting the occurrence, exploitation, and utilization of fossil fuels, nuclear energy, wind and water power, tidal energy, and exotic energy sources; methods, magnitude, and reliability of resource estimates. Prerequisite: Geology 101, 102, or 107, or Geology/Liberal Arts and Sciences 142 or 143. 2 hours.
106. **Exploring the Earth.** Selected examples of the application of geology to the exploration for oil and other mineral resources; intended primarily for nonscience students. Prerequisite: Geology 101 or 102. 2 hours.
107. **General Geology.** Primarily for science and science-oriented students; concerns the physical, chemical, and biological evolution of the earth. No more than 8 hours of credit may be received for Geology 101, 102, 107, and 108. Students may not receive credit for Geology 107 and Geology 104 or Geology/Liberal Arts and Sciences 143. 4 hours.
108. **General Geology.** Continuation of Geology 107; primarily for science and science-oriented students. Field trip required. No more than 8 hours of credit may be received for Geology 101, 102, 107, and 108. Students may not receive credit for Geology 108 and 103 or 104. Prerequisite: Geology 107 or consent of instructor. 4 hours.
115. **Regional Field Study.** Field observations in a region of diverse geology. One- to two-week field trip. Credit is given only on completion of a satisfactory written report. Prerequisite: Geology 101, 102, 107, 142, or 250. 2 hours.
142. **Physical Science in Modern Society.** Same as Liberal Arts and Sciences 142. Physical science for nonscience majors; emphasizes the basic chemical and physical aspects of the earth's environmental systems and the impact of modern technology on these systems. 3 hours.
143. **Environmental Physical Science.** Same as Liberal Arts and Sciences 143. Physical science for nonscience majors; emphasizes earth processes and resources relevant to mod-

ern society, including the availability and by-products of utilization of energy and water resources and the limitations imposed by earth processes on society. Students may not receive credit for Geology/Liberal Arts and Sciences 143, and Geology 101 or 104. 3 hours.

170. **Introduction to Oceanography.** Introduction to the physical, chemical, geological, and biological study of the oceans and the sea floor; intended for nonscience majors. Prerequisite: Geology 101 or 102, Geology/Liberal Arts and Sciences 142 or 143, or consent of instructor. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
215. **Field Geology.** Field course to be conducted from a suitable geologic locality; introduction to field techniques, geologic mapping, and field training in stratigraphy, structure, and geomorphology. Prerequisite: Geology 108 or consent of instructor. 8 hours. Offered in the summer session only.
222. **Paleontology and Stratigraphy.** Systematic study of fossils, their classification and morphology, and general principles of stratigraphy. Students may not receive credit for both Geology 222 and 320. Prerequisite: Geology 102 or 108. 4 hours.
233. **Minerals and Rocks.** Systematic study of minerals and rocks with emphasis on their nature as crystalline materials, their occurrence and geologic relationships, and their economic significance. Field trip required. Prerequisite: Chemistry 101 or Geology 102 or 108, or consent of instructor. 4 hours.
250. **Geology for Engineers.** Physical geology with an emphasis on those aspects of the natural environment which are of importance to the engineer. Prerequisite: Theoretical and Applied Mechanics 150 or 152; sophomore standing in the College of Engineering. 3 hours.
290. **Individual Study.** Research and individual study. Students desiring honors designation for Geology 290 should complete an Honors Credit Learning Agreement with their supervising faculty member. Prerequisite: Consent of supervising faculty member. 2 to 4 hours. A maximum of 8 hours may be counted toward graduation.
292. **Senior Thesis.** Research, with thesis; a thesis must be presented for credit to be received. Students desiring honors designation for Geology 292 should complete an Honors Credit Learning Agreement with their supervising faculty member. Prerequisite: Consent of supervising faculty member. 2 to 8 hours. A maximum of 10 hours may be counted toward graduation.
301. **Geomorphology.** History, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion or by a combination of these acting upon the major kinds of geologic materials and structures. Lectures, laboratory, and field trips. Prerequisite: Geology 108 or consent of instructor. 4 hours or 1 unit.
303. **History of Geology.** Development of the fundamental concepts of the geological sciences from classical to modern times. Prerequisite: Geology 108 or consent of instructor. 4 hours or 1 unit.
309. **Sedimentology.** Introduction to principles of sediment erosion, transport, and deposition; origin of sediment texture, sedimentary structures, sedimentary sequences, sediment mineralogy, and diagenesis; and sediment deposition in fluvial, deltaic, deep water, tidal flat, continental shelf, and beach and barrier island environments. Prerequisite: Geology 108 or consent of instructor. 2 hours or ½ unit.
310. **Field and Laboratory Procedures in Sedimentology.** Introduction to the field and laboratory study of Holocene sediments and sedimentary rocks, with emphasis on field sampling, sieve-size analysis, peel making of unconsolidated sediments and sedimentary rocks, x-ray radiography, disaggregation of sediments, heavy mineral analysis, mineral identification by staining, pH-Eh determinations, and thin-section preparation. Required field work. Must be taken concurrently with Geology 309. Prerequisite: Geology 108 or consent of instructor. 1 hour or ¼ unit.
311. **Structural Geology.** Rock deformation and its results. Lectures, laboratory, and required field trip. Prerequisite: Geology 108 or consent of instructor. 4 hours or 1 unit.

315. **Advanced Field Methods.** Mapping a structurally and/or stratigraphically significant area of moderate size and difficulty; preparation of a report. Prerequisite: Geology 215. 2 to 8 hours, or $\frac{1}{2}$ to 2 units.
320. **Invertebrate Paleontology.** Fossil groups in the biological sequence. Lectures, laboratory, and required field trip. Students may not receive credit for both Geology 320 and 222. Prerequisite: Geology 108 or consent of instructor. 4 hours or 1 unit.
321. **Principles of Stratigraphy.** Definition of stratigraphic units, correlation, facies, paleogeography, and historical inference; techniques of physical stratigraphy; and required field trips. Prerequisite: Geology 108 or consent of instructor. 4 hours or 1 unit.
325. **Paleobotany.** Same as Botany 325. Structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. Prerequisite: Botany 100, or Biology 100 and 101; Geology 101 or 107; or consent of instructor. 5 hours or 1 unit.
328. **Introductory Micropaleontology.** Morphology, classification, biology, and ecologic-stratigraphic distribution of major microfossil groups of the Cenozoic, Mesozoic, and Paleozoic; applications to biostratigraphic and paleoecologic problems. Prerequisite: Geology 320 or consent of instructor. 4 hours or 1 unit.
332. **Mineralogy-Petrology.** Introduction to the structure, chemistry, and stability of the major silicate minerals and their occurrence in rocks; required field trip. Prerequisite: Geology 108 or consent of instructor; Chemistry 102 or 108. 4 hours or 1 unit.
335. **Optical Mineralogy.** Study of crystalline matter, especially minerals, by polarized light microscopy and powder x-ray diffractometry. Prerequisite: Geology 332. 4 hours or 1 unit.
336. **Igneous and Metamorphic Petrography.** Study of the constituents, composition, texture, structures, and classification of igneous and metamorphic rocks; laboratory study of rocks in hand specimen and thin section. Prerequisite: Geology 335. 4 hours or 1 unit.
338. **Introduction to Sedimentary Petrography.** Introduction to the microscopic study of sedimentary rocks in thin section with emphasis on their textural properties as a basis for their classification and environmental interpretation. Prerequisite: Geology 335. 2 hours or $\frac{1}{2}$ unit.
350. **Theoretical Geophysics.** Introduction to the major fields of theoretical geophysics: figure of the earth, thermodynamics of the earth, gravity, seismology, magnetism, and planetary geophysics. Prerequisite: Mathematics through calculus; one year of physics; Geology 311; consent of instructor. 4 hours or 1 unit.
351. **Geophysical Prospecting.** Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
357. **Glacial and Pleistocene Geology.** Consideration of glacial flow, erosion, and deposition; stratigraphic analysis of glacial deposits and correlation of Pleistocene glacial successions with nonglacial sediments; and field trip and required field work. Prerequisite: Consent of instructor. 4 hours or 1 unit.
360. **Chemistry of the Earth.** Fundamental chemical and physical concepts applied to earth surface processes, the history of the earth as a chemical system, and the relation of the earth to the solar system and the universe. Background in both physical chemistry and geology would be helpful. Prerequisite: Consent of instructor. 4 hours or 1 unit.
370. **Oceanography.** Principles of biological, chemical, geological, and physical marine science. Prerequisite: Botany 100; Chemistry 101, Geology 101 or 107, and Physics 101; or consent of instructor. 4 hours or 1 unit.
403. **Physical Systems in Landform Analysis.** Same as Geography 403. A study of the phenomena of the physical landscape in terms of the basic principles of mechanics and systems theory. Prerequisite: Geography 303 or equivalent, or consent of instructor. 1 unit.
415. **Regional Field Geology.** Field study of critical localities within a geologic province during a period of two or three weeks; discussion of observations and preparation of reports in which the concepts and principles mastered in graduate study are applied to regional geologic synthesis. Prerequisite: Consent of instructor. 1 unit.

420. **Paleoecology.** Interpretation of life habit of fossil organisms from skeletal morphology and associated depositional features; reconstruction of marine ecosystem relationships from the study of assemblages of fossils. Prerequisite: Geology 320 or equivalent. 1 unit.
421. **Advanced Invertebrate Paleontology.** Intensive study of a selected invertebrate group. Prerequisite: Geology 320 or Zoology 320. 1 unit. May be repeated for credit.
422. **Advanced Stratigraphic Geology.** The concept of the Phanerozoic eras, periods, stages, and zones; evaluation of the type sequences and the succession of faunas; and problems of correlation and historical inference. Prerequisite: Consent of instructor. 1 unit.
428. **Advanced Micropaleontology.** Detailed study of the morphology, biology, and distribution in time and space of a major microfossil group, most commonly conodonts, ostracods, benthic foraminifers, or calcareous plankton; emphasizes biostratigraphic or paleoecologic applications. Prerequisite: Geology 328 or 320, Zoology 320, or equivalent; or consent of instructor. 1 unit. May be repeated to a maximum of 3 units.
431. **Structural Mineralogy.** Principles of the crystal chemistry and structural classification of minerals; survey of the current knowledge about the structures and structurally dependent properties and behavior of representative minerals and mineral groups. Prerequisite: Consent of instructor. 1 unit.
432. **Sedimentary Geochemistry.** Equilibrium assemblages among the principal organic and inorganic sedimentary solids and their associated liquids during weathering, deposition, and diagenesis; kinetics and mechanism of phase changes; and transport processes during diagenesis. Prerequisite: Geology 360 or equivalent, or consent of instructor; some background in physical chemistry desirable. 1 unit.
434. **Theoretical Petrology.** Use of thermodynamic and kinetic arguments in the solution of basic petrological problems. Prerequisite: Consent of instructor. 1 unit.
435. **Igneous and Metamorphic Petrology.** Application of chemistry and physics to the study of crystalline rocks, with emphasis on the integration of theory with field and laboratory observations; topics selected on the basis of student interest and training. Prerequisite: Geology 336. 1 unit. May be repeated for credit.
437. **Sedimentary Processes.** Application of fluid mechanics to quantitative analysis of erosion, transport, and deposition by open channel flow, waves, tidal currents, longshore currents, turbidity currents, wind, and ice; quantitative determination of origin of physical sedimentary parameters and sedimentary mineralogy; and processes of weathering and diagenesis. Field trip required. Prerequisite: Geology 335 or equivalent, or consent of instructor. 1 unit.
438. **Sedimentary Petrography.** Microscopic study of sedimentary rocks in thin section with emphasis on textures and structures as a basis for their detailed classification and genetic interpretation. Prerequisite: Geology 335 and 437. 1 unit.
443. **Mineral Deposits.** Principles of mineral deposition and genesis of mineral deposits; required field trip. Prerequisite: Geology 311. 1 unit.
450. **Principles of Engineering Geology.** Study of the effects that lithology, weathering, joints, faults, and ground water have upon engineering projects. The origin, exploration, description, analysis, and significance of geologic factors are studied and illustrated with case histories. A required field trip is an integral part of the course. Prerequisite: Geology 250 or equivalent, or consent of instructor. 1 unit.
451. **Practice of Engineering Geology.** Study of current and past case histories that illustrate the applications of the principles of engineering geology; includes studies where lithology, weathering, joints, faults, and ground water have influenced the exploration, design, construction, and maintenance phases of engineering projects. A required field trip to visit engineering construction projects is an integral part of the course. Prerequisite: Geology 450 and Civil Engineering 383, or consent of instructor. 1 unit.
455. **Hydrogeology.** Geology of the occurrence, storage, movement, and quality of water in the rocks of the earth's crust. Prerequisite: Consent of instructor. 1 unit.
461. **Mineralogy of Clays.** Same as Ceramic Engineering 461. Composition of various types of clays; the structure and properties of the clay minerals; and the origin and mode of

- occurrence of the clay minerals and clay materials. Field trip required. Prerequisite: Geology 336 or equivalent; consent of instructor. 1 unit.
462. **Mineralogy of Clays.** Same as Ceramic Engineering 462. Properties of clay materials, their relation to the structure of the clay minerals, and methods of determination and control; the utilization of clays in various arts and industries; and required field trip. Prerequisite: Geology 461. 1 unit.
471. **Submarine Geology.** General geology of the ocean basins and continental margins, with emphasis on the geological interpretation of marine geophysical investigations. Prerequisite: One year of physics or consent of instructor. 1 unit.
477. **Recent Sedimentary Environments.** Review of sedimentary processes, physical sedimentary parameters, and sedimentary mineralogy in fluvial, lake, dune, beach, barrier island, bar, deltaic, tidal flat, lagoonal, bay, marsh, continental shelf, continental margin, submarine fan, submarine canyon, and deep ocean floor environments; sedimentological aspects of land usage, and conservation and preservation of man's environment. Prerequisite: Geology 437 or consent of instructor. 1 unit.
479. **Mathematical Geology.** Analysis of the geologic assumptions necessary to fulfill mathematical requirements in numerical analysis of geologic problems. Prerequisite: Mathematics 161 or Agronomy 340; Computer Science 101; consent of instructor. 1 unit.
480. **Mathematical Methods in Geology.** Introduction to and application of the mathematical topics utilized in the geological sciences. Prerequisite: Mathematics 135 and 145, or equivalent. 1 unit.
481. **Transport Processes in Geology.** Introduction to the basic concepts of energy, mass, and momentum transport and their application to problems in the geological sciences. Prerequisite: Geology 480 or consent of instructor. 1 unit.
488. **Advanced Structural Geology.** Analysis of geologic deformation based upon the principles of mechanics and utilizing research data from laboratory and field investigations; methods in structural analysis. Prerequisite: Geology 311 or consent of instructor. 1 unit.
489. **Geotectonics.** Nature and distribution of major earth structures and geological and geophysical evidence bearing on their origin. Prerequisite: Geology 311 or consent of instructor. 1 unit.
493. **Advanced Studies in Geology.** $\frac{1}{4}$ to 2 units. Work may be taken in the following fields: (a) clay mineralogy; (b) engineering geology; (c) geomorphology and glacial geology; (d) general geology; (e) ground-water geology; (f) micropaleontology; (g) mineral deposits; (h) mineralogy and crystallography; (i) paleontology; (j) geochemistry; (k) geophysics; (l) petrography and petrology; (m) sedimentology; (n) stratigraphy; (o) oceanography; (p) submarine geology; (q) structural geology and geotectonics; and (r) mathematical geology.
499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

GERMAN

(See Germanic Languages and Literatures under Humanities, School of)

GERMANIC

(See Germanic Languages and Literatures under Humanities, School of)

GREEK

(See Classics under Humanities, School of)

GREEK, MODERN

(See Classics under Humanities, School of)

HEALTH AND SAFETY EDUCATION

Head of Department: Professor W. H. Creswell, Jr.

Department Office: 121 Huff Gymnasium, Champaign

Health Education

110. **Public Health.** Basic principles of group living including epidemiology studies; scientific methods as applied to environmental health in urban and rural areas; and specialized programs. Field trips. Prerequisite: Two hours credit in health education or sophomore standing. 2 hours.
150. **Health and Modern Life.** Dynamics of health in modern life in a rapidly changing world; modern concepts of health, disease, and longevity; current health problems, issues, and trends; scientific health facts, principles, and theories related to personal, family, and community health; and health and longevity progress in the United States. Designed primarily as a professional course for prospective health and safety educators, coaches, physical educators, and recreation workers. Prerequisite: Consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Mental Health.** Introduction to the science of mental health and illness including personality development, the genesis and manifestations of mental illness, and the maintenance of mental health; taught by a psychiatrist with emphasis on the preventive and medical aspects of mental health. 2 hours.
206. **Sex Education and Family Life.** Offered to persons who are interested in becoming more critical and obtaining a larger perspective in their understanding of the problems of sex and family life. Prerequisite: Junior standing or consent of instructor. 2 hours.
216. **Medical Terminology Correlated with Community Health Problems.** A preprofessional course for those entering the occupational therapy curriculum, medical journalism, and paramedical fields. Occupational therapy students are given priority the fall semester. Prerequisite: Junior standing; enrollment in the occupational therapy curriculum. 3 hours.
233. **Observation and Participation in School Health and Safety Education.** Prerequisite: Health Education 150 and sophomore standing. 3 hours.
236. **Tomorrow's Environment.** Same as Environmental Studies 236. Introduction to the environmental problems of a finite world; temporal perspective on impacts on the nat-

ural ecosystem and the resulting limits on growth; and projections of environmental conditions based upon understanding relevant natural systems and human impacts under alternative management strategies. Prerequisite: One course in the life sciences and one course in the social sciences, or consent of instructor. 3 hours.

241. **Techniques of Teaching in the Secondary Schools.** Same as Secondary Education 241. Methods of teaching specific subject matter fields in the secondary school; special sections provided in the usual high school subjects. Prerequisite: History and Philosophy of Education 201; Secondary Education 240; concurrent registration in Educational Practice 242; consent of instructor. This course meets only during the first eight weeks of the semester. 3 to 5 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the students. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser and instructor, and approval of the head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours.
260. **Honors Seminar.** Same as Physical Education 290, and Leisure Studies 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours.
281. **First Aid.** American Red Cross standard course in first aid. 2 hours.
282. **Organization of School Health Programs.** Developing school health programs, including health service, healthful school living, and health instruction based on the needs and problems of school children. 3 hours.
283. **Man and His Diseases.** Ecologic, including cultural, factors affecting disease in man; changing concepts of disease; epidemiology of communicable and noncommunicable diseases; and disease prevention and control. Designed primarily for prospective health teachers in the high schools and colleges and public health educators. Prerequisite: Health Education 110 and 150; Physiology 103. 2 hours.
285. **Sex Education for Teachers.** Theory and practice of family life and sex education. Includes basic issues, philosophy, and guiding principles; state laws and their implementation; needs, justification, and objectives; curriculum in human sexuality; content knowledge, microteaching and evaluation stressing classroom techniques appropriate to sex education at various levels K-12; resource materials and their use in the classroom; and coverage of controversial topics. Prerequisite: Junior standing. 4 hours.
288. **Curriculum Development and Evaluation in Health Education.** The application of principles of planning for and managing the health education classroom through the exploration of decision making and valuing strategies; includes planning for effective health instruction and evaluating the school health program. Prerequisite: Health Education 282. 3 hours.
289. **Public Health Field Work.** Supervised field experiences in official, voluntary, and professional health agencies; designed to give students in community health work experience in actual field situations. During the junior or senior year, students work for one semester in University-approved health agencies for a minimum of sixty hours of field work. Prerequisite: Junior standing in community health education. 2 hours.
303. **Delivery of Health Care: Problems and Perspectives.** Same as Social Work 303. The wide range of factors--ecological, social, cultural, medical, organizational, economic, and political--which influence health care in a complex nation like the United States; attention to perspectives from various fields of study. Prerequisite: Junior standing and consent of instructor. 3 hours or 1 unit.
345. **Family Planning and Population Policy.** Same as Social Work and Sociology 345. Background information for professionals involved in the field of family planning; includes historical and current trends in developing and developed nations, with emphasis on the United States; and examines family planning and population policies, and

- programs and contraceptive methods as related to service delivery and to professional roles. Prerequisite: Consent of instructor. 3 hours or 1 unit.
374. **General Epidemiology.** Same as Environmental Studies, Medical Sciences, Veterinary Medical Science, and Veterinary Pathology and Hygiene 374. The epidemiology and natural history of infectious and noninfectious diseases, including integrated vector control and host resistance, and mental health and public health. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent, or consent of instructor. 4 hours or 1 unit.
390. **Public Health Education.** Theory and practice of community health education; adult health education through media such as radio, television, films, slides, posters, pamphlets, and newspapers; projects in preparing and using public health education materials; and evaluation of research in public health education. Prerequisite: Senior or graduate standing in health education, or consent of instructor. 3 hours or ½ unit.
391. **Health Data Analysis.** Introduction to public health statistics including collection and classification of data; rates and other indices; measures of central tendency and dispersion; tests of significance; and use of vital statistics in planning, conducting, and evaluating public and school health education programs. Prerequisite: Mathematics 161 or Educational Psychology 390, or equivalent. 2 hours or ½ unit.
392. **Health and Safety Education in the Elementary School.** Overview of the school health program to acquaint the teacher with modern concepts of health and safety education in the elementary school; consideration of the role of the classroom teacher in understanding and meeting the health needs of children; and focus on the legal requirements for Illinois schools, major health and safety problems of elementary children, the teacher's role in the school health program, and methods and materials in teaching modern health and safety education. Prerequisite: One year of biological science. 3 hours or ½ unit.
393. **Drug Abuse Education.** Psychosocial, pharmacological, and legal aspects of drug use and abuse; school and community responses to drug abuse; and the development of appropriate curricula, materials, and teaching strategies for combatting drug use and abuse. Prerequisite: Six hours of health education or consent of instructor. 2 hours or ½ unit.
400. **Scientific Foundations of Health Education.** Designed to reinforce and extend the student's knowledge of pertinent scientific health facts and principles as these apply to further improvement of personal, family, and community health. Prerequisite: Undergraduate courses beyond the elementary level in the biological and physical sciences and in health education. ½ or 1 unit.
401. **Problems in School Health Education.** History, philosophy, principles, and practices of school health education in its three main phases: health service, healthful school environment, and health instruction, including evaluation. ½ or 1 unit.
403. **Problems in Public Health.** Basic facts and principles of public health at the local, state, and national levels, including the relationships between public health departments, voluntary health agencies, and the school health program. ½ or 1 unit.
404. **Trends and Issues in Sex Education.** Critical analysis of current trends and basic issues of sex education; study of present status of sex education in the United States and selected foreign countries; and a critical analysis of philosophy, principles, methods, and current problems in sex education. Prerequisite: Undergraduate courses beyond the elementary level in the biological and social sciences, Health Education 285 or equivalent, or consent of instructor. ½ or 1 unit.
405. **School Health Administration.** Study of the principles of administrative theory in school health programs; includes extensive use of case and critical incident materials. 4 hours or 1 unit.
490. **Seminar.** Student presentation of thesis reports in health and safety education; informal discussions, lectures, and critical analysis of current problems in health and safety education. Prerequisite: Health Education 495. 0 credit.

493. **Special Projects.** Independent research on special projects. Prerequisite: Educational Psychology 390, Physical Education 495, and Health Education 400 or equivalent. $\frac{1}{2}$ to 2 units. May be repeated to a maximum of 2 units.
494. **Special Topics in Health Education.** Lectures on topics of current interest. $\frac{1}{2}$ or 1 unit.
495. **Research Methods in Health and Safety Education.** Special emphasis on research orientation and methods; experimental design; processing and analysis of data; selection of research problems and preparation of thesis; and current research literature in health and safety education. Prerequisite: Educational Psychology 390 or equivalent. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Preparation of theses in health and safety education. Prerequisite: Health Education 495. 0 to 4 units.

Safety Education

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
280. **Safety Education.** Understanding and appreciating the place of safety in modern life; the teaching of safety in the elementary and secondary schools; need for psychological considerations; planning and methods of teaching; safe school environment and liability; materials; safety education for elementary and secondary schools; a safety program for areas outside the school; human experience; and testing and evaluating. 3 hours.
284. **Driver Education.** Cause and extent of highway accidents; laws and regulations; method of instructing high school students in the proper attitudes, habits, and skill in driving; demonstrations and practice in the use of a dual control car; and psychophysical testing equipment. Prerequisite: Up-to-date driver's license; junior standing; proficiency in driving automatic and standard transmission vehicles. 3 hours.
289. **Safety Education Field Work.** Supervised field experiences in official, voluntary, and professional safety agencies; designed to give students in public safety education work experience in actual field situations. During the junior or senior year or during the summer, students work for one semester in University-approved safety agencies for a minimum of sixty hours of field work. Prerequisite: Senior standing in public safety education. 0 credit.
294. **Advanced Traffic Safety Education.** Designed to provide advanced preparation in principles and practices of driver and traffic safety education for teachers, supervisors, and administrators; includes a study of the relationship of psychology, sociology, and engineering to driver education and traffic safety; modern methods and materials; traffic legislation and enforcement; laboratory work with various psychophysical tests; and a critical consideration of current research findings. Field trip and two hours per week laboratory to be arranged. Prerequisite: Safety Education 284 or consent of instructor. 3 hours.
384. **Simulated Teaching Systems for Traffic Safety.** Development of conceptual foundations and the acquisition of skills in the use of multimedia teaching; includes laboratory experiences in the use of multiple-care driving facilities, simulated driving systems, and electronic classroom systems; analysis and review of the traffic safety education problem and its relationship to multimedia instruction programs; role of multimedia instruction in traffic safety; analysis and review of multimedia instruction techniques; use of multimedia in the teaching-learning process; research and analysis of research in the use of driving simulators and multiple-care driving range instruction; and development of conceptual foundations and acquisition of skills in the use of multimedia facilities. Prerequisite: Safety Education 284. 3 hours, or $\frac{1}{2}$ to 1 unit.
394. **Special Topics.** Lecture and laboratory experiences of current interests and issues; specific subject matter will be announced in the *Timetable*. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated to a maximum of 8 hours or 2 units.
402. **Problems in Safety Education.** Philosophy of safety; traffic, recreation, home, and industrial safety facts and figures; the safety problem and its relation to education; orga-

nization of safety education programs; methods of teaching; legal aspects; and research problems. $\frac{1}{2}$ or 1 unit.

494. **Special Topics in Safety.** Lectures on topics of current interest. $\frac{1}{2}$ or 1 unit.

HEBREW

(See Linguistics under Humanities, School of)

HEBREW, MODERN

(See Linguistics under Humanities, School of)

HINDI

(See Linguistics under Humanities, School of)

HISTORY

(See Humanities, School of)

HOME ECONOMICS

Director of School of Human Resources and Family Studies: Professor P. C. Paul
School Office: 260 Bevier Hall, Urbana

105. **Introduction to Human Development.** Systematic overview of the biological, psychological, familial, and cultural factors related to human growth and development throughout the life cycle. 3 hours.
106. **Observation and Analysis of Behavior.** Developmental criteria applied to observation data; inclusion of natural and laboratory settings to give students skill in recording and interpreting human behavior with emphasis on the child. Prerequisite: Credit or concurrent registration in Home Economics 105. 3 hours.
120. **Contemporary Nutrition.** Fundamental principles of human nutrition and their application to the selection of adequate diets; current topics of nutritional importance; for non-home economics majors. Prerequisite: Sophomore standing. 3 hours. No credit to home economics concentrators except by special approval.
125. **Food Selection and Preparation.** Elementary study of foods in relation to market selection, preparation methods, and standards; comparative costs and food values; and principles of meal planning. For non-home economics majors. Prerequisite: Sophomore standing. 3 hours.
132. **Foods and Nutrition.** An introductory course in foods and nutrition emphasizing the relationship of nutritional principles to food choices and food preparation techniques. Students may not receive credit for Home Economics 132, and Home Economics 120 or

125. Prerequisite: Chemistry 100 or placement by examination in Chemistry 101. 3 hours.
133. **Food Management.** Study of factors involved in management of food for the family; food costs and buying; and meal planning and service. Prerequisite: Home Economics 132. 2 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology, Psychology, and Zoology 143. Critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior; topics include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
160. **The Home and Its Furnishings.** Design fundamentals involved in the development and selection of family housing to meet human needs; consideration of the aesthetic, social, economic, and functional aspects of residential environment. 4 hours.
171. **Home Management.** Principles of management related to the resources of the student and of the family; emphasis on the use of time, energy, and money. 2 hours.
182. **Clothing Laboratory: Basic Construction.** Fundamental principles of clothing construction; developmental work with pattern, fabric, and equipment as related to fit, design, fabric, and garment assembly. For students with little or no formal experience in clothing construction. 2 hours.
183. **Consumer Textiles.** Analysis of textile products as a basis for consumer choice. 2 hours.
184. **Apparel Design and Selection.** Theory and practice in applying art principles and symbolism in dress to design and selection of apparel. Prerequisite: Art 185 or consent of instructor. 2 hours.
186. **Clothing Laboratory: Tailoring.** Comparisons of tailoring techniques in the construction of garments; comparison of standard construction and tailoring techniques appropriate to design and fabric. Prerequisite: Home Economics 182, or 4-H, or high school clothing construction course, or consent of instructor. 2 hours.
194. **Primary Structures in Weaving.** Exploration of basic elements in weaving and related processes; focus on primitive, traditional, and experimental methods of forming cloth. Prerequisite: Art 119 or 185, or equivalent. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
202. **Laboratory in Child Development.** Planning for educational experience in various preschool settings and at home; techniques of teaching and guiding the young child derived from developmental and educational research; and direct contact experience with young children in selected environments. Prerequisite: Home Economics 105, and Psychology 100 or 103. 3 or 4 hours.
203. **Child Development: Period of Infancy and Early Childhood.** Study of the growth and development of young children; their biological and psychological needs and the environmental influences affecting their development and relationships with others; gives an understanding of the developmental sequences and the basic principles of child care and training. Prerequisite: Home Economics 105 or Psychology 216. 4 hours.
204. **Motor Development in Childhood.** Same as Physical Education 262. Study of the selection of specific movement experiences for the elicitation and maintenance of developmental sequences in children and youths based on physical growth and motor development; observational experiences provided with children in a variety of settings. Prerequisite: Physical Education 250 or Home Economics 105. 3 hours.
210. **Family Relationships.** Same as Anthropology 210. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; and examination of selected family adjustment problems. 3 hours.
220. **Principles of Nutrition.** Nutritive value of foods and metabolism of essential nutrients; application of principles of nutrition to the requirements of normal individuals throughout the life cycle. Prerequisite: Chemistry 102; Home Economics 132; Physiology 103. 3 hours.

231. **Foods.** Composition and behavior of foods; application of chemistry and other physical sciences to principles of food preparation. Prerequisite: Chemistry 102; Home Economics 133. 3 hours.
240. **Quantity Food Production and Service.** Application of the principles of food preparation and service to institutional and commercial feeding. Prerequisite: Food handlers certificate; Economics 101; Home Economics 231; consent of instructor. 2 to 5 hours.
260. **Interiors and Furniture, I.** Development of residential environments from prehistoric times to the nineteenth century as seen through the study of architecture and furniture design; consideration of the adaptation and use of period styles in contemporary interiors. Prerequisite: Art 119 or 185, or equivalent. 3 hours.
261. **Interiors and Furniture, II.** Continuation of Home Economics 260. Study of the development of residential environments of the nineteenth and twentieth centuries. Prerequisite: Home Economics 260. 3 hours.
262. **Interior Design.** Designing of interiors and their components; emphasis on design theory, presentation techniques, and evaluation of design concepts. Prerequisite: Home Economics 160 and 261; Art 118, 120, and 123. 3 hours.
263. **Textile Design: Printing.** Creative design developed from historical and traditional background; exploration of various printing techniques, such as block, stencil, and silk screen processes, on fabric; and an analysis of contemporary American design. Prerequisite: Art 120 or 186; consent of instructor. 3 hours.
270. **Family Financial Management.** Application of managerial principles to family finances; consideration of factors affecting the acquisition and use of income, plans for spending and saving during various periods in the family cycle, and the relationship of income to the economic situation. Prerequisite: Economics 101 or equivalent; Home Economics 171. 3 hours.
271. **Home Management.** Introduction to home management concepts; application of managerial principles to use of time, energy, and money; and emphasis on consumer goods and services accounting for some major costs of living. For non-home economics majors. 2 hours.
273. **Advanced Home Management.** Seminar course with field experience emphasizing an analytical approach to the study of managerial behavior of families. Prerequisite: Economics 101; Home Economics 171, 210, 220, and 231; Psychology 100 or 103; junior standing in home economics; consent of instructor. 3 hours.
280. **Household Textiles.** Selection of household textiles for consumer use. Prerequisite: Home Economics 183. 2 hours.
281. **Nontextile Apparel and Accessory Materials.** Consumer information about the selection and care of apparel and accessory items of leather, fur, plastic, and metal. Prerequisite: Home Economics 183. 2 hours.
284. **Costume Design.** Creative clothing design using art principles through the media of sketch and color; designing clothing suited to figure type and personality; and understanding the influence of design on contemporary clothing. Prerequisite: Art 120 or 186; Home Economics 184. 2 hours.
285. **History of Costume.** Costumes and their settings from the early Egyptian period through the nineteenth century. 2 hours.
286. **Clothing Design: Flat Pattern.** Designing by drafting patterns using sources of design inspiration appropriate for this process; fitting a basic pattern to use in designing and making a garment. Prerequisite: Art 120 or 186; Home Economics 182 or 186; Home Economics 183 and 184. 3 hours.
287. **Consumer Clothing Problems.** Psychological, sociological, economic, and hygienic aspects of consumer reactions to clothing. Prerequisite: Economics 101; Home Economics 183 or 184; Psychology 100 or 103; Sociology 100. 2 hours.
291. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.
292. **Thesis.** Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours.

294. **Advanced Weaving.** Exploration of traditional and experimental methods of developing fabrics by means of the floor loom. Prerequisite: Home Economics 194. 3 hours.
301. **Advanced Problems in Home Guidance of Children.** Emphasis on the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view toward helping students understand the less obvious and more subtle aspects of child development, and to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. Prerequisite: Home Economics 202 and 203; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **Economics of Consumption.** Same as Economics 313. Analysis of the macro and micro aspects of consumption. Prerequisite: Economics 101 or equivalent; a course in applied statistics; junior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
320. **Diet in Disease.** Application of the science of nutrition to the maintenance of optimum health and the role of nutrition in the prevention and treatment of disease. Prerequisite: Home Economics 220. 3 hours or $\frac{3}{4}$ unit.
322. **Physical Growth and Nutrition.** Lecture, readings, and discussions. Prerequisite: Home Economics 220; senior standing; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
323. **Recent Advances in Foods and Nutrition.** New developments in foods and nutrition; readings, lectures, and discussions. Prerequisite: Chemistry 102; Home Economics 220 and 231; Physiology 103. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
324. **Biochemical Aspects of Human Nutrition.** Same as Food Science 324. Advanced treatment of human nutrition, with emphasis on the biochemical functions of nutrients essential for man. Prerequisite: Biochemistry 350, Biochemistry 352 and 353 and a course in nutrition, or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Students may not receive credit for Food Science/Home Economics 324 and Food Science 320.
326. **Presentations: Principles and Techniques.** Selection of problems and organization of materials for demonstrations and other presentations in home economics subject-matter areas. Field trip; see *Timetable* for approximate cost. Prerequisite: Senior standing; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
330. **Experimental Foods.** Consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. Prerequisite: Home Economics 231; Microbiology 100 and 101. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Problems in Foods.** Individual problems in food preparation and preservation. Prerequisite: Home Economics 330. 3 hours or $\frac{3}{4}$ unit.
345. **Institution and Restaurant Management: Food Purchasing and Equipment Selection.** Purchasing food and selecting equipment for quantity food service; factors affecting the purchase of food; and the relationship of floor plans and equipment to service. Field trip; see *Timetable* for approximate cost. Prerequisite: Credit or concurrent registration in Home Economics 240; Economics 101. 3 hours or $\frac{1}{2}$ unit.
349. **Music in Early Childhood.** Same as Music 349. Detailed consideration of the music program in nursery schools, kindergarten, and the primary grades; topics include the nature of early musical responses, objectives, experience levels of the program, methods of teaching, and materials; and inclusion of observation of music teaching at the Child Development Laboratory. Prerequisite: Senior or graduate standing in music or home economics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
350. **Institution and Restaurant Management: Organization and Administration.** Organization and administration of food service operations; management problems in various types of food service: personnel, costs, and sanitary control. Field trips; see *Timetable* for approximate cost. Prerequisite: Home Economics 220 and 240. 4 hours or 1 unit.
354. **Growth and Physical Development of Children.** Same as Physical Education 354. A study of the growth and physical development of children through adolescence with emphasis on those systems and body composition changes related to motor performance and exercise stress. Prerequisite: Physiology 103 and 234; Physical Education 270; or equivalent. 3 hours or 1 unit.
355. **Specialized Quantity Food Production and Management.** Advanced application of food production and management principles to specific food service demands; emphasis

- on artistry in preparation, serving, and merchandising high quality food in quantity. Prerequisite: Home Economics 240, credit or concurrent registration in Home Economics 350, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
361. **Development and Function of Family Housing.** Same as Agricultural Mechanization 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials, and structure; economic influences, costs, and adaptations; and personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural mechanization students, no prerequisite). 3 hours or $\frac{3}{4}$ unit.
370. **Family Economics.** Same as Agricultural Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 101 or equivalent; a course in applied statistics; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.
371. **The Family as a Consuming Unit.** Analyzes the contributions of economics, sociology, psychology, anthropology, and areas in home economics to understanding the role of the family as a consuming unit; deals with the three aspects of consumer activities (choice making, buying, and using). Prerequisite: Six hours of social science. 3 hours, or $\frac{3}{4}$ or 1 unit.
375. **Home Equipment.** Consideration of basic principles related to the selection, use, and care of household equipment; individual problems including an evaluation of sources of information on equipment and equipment performance tests. Prerequisite: Home Economics 171; 6 advanced hours in home economics including one of the following: 231, 273, or 380; senior standing; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
377. **Cooperative Extension: Home Economics.** The philosophy, history, and organization of the cooperative extension service; consideration of program development and methods of presentation and evaluation emphasizing socioeconomic characteristics of state and county. Prerequisite: Economics 101; Psychology 100 and Sociology 100, or Educational Psychology 211, or Agriculture 206; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
378. **Problems in Home Management, Housing, and Interior Design.** Individual investigations and reports of specific problems in the fields of home management, family housing, or interior design. Prerequisite: Home Economics 262 or 270; senior standing; consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
379. **Problems in Family and Consumption Economics.** Individual investigations and reports of specific problems in the field of family and consumption economics. Prerequisite: Economics 101 or equivalent; a course in applied statistics; Home Economics 313, 370, 371, or consent of instructor; senior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Advanced Textiles.** Effects of the physical and chemical structures of textile fibers on their properties, manufacturing processes, use, and care. Prerequisite: Home Economics 183; Chemistry 102. 4 hours or 1 unit.
386. **Clothing Design: Draping.** Designing by draping inspired by appropriate design sources; understanding of fitting principles through fabric manipulation; and design effects maintained in garment construction. Prerequisite: Home Economics 285 or consent of instructor; Home Economics 286. 4 hours or 1 unit.
388. **Problems in Textiles and Clothing.** Individual problems in the field of textiles and clothing, retailing of clothing, or weaving. Prerequisite: Home Economics 286, 294, or 380, or Business Administration 212; minimum grade-point average of 3.5; senior standing; consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
395. **Fashion Analysis.** Study of fashion terminology, selected designers, garment-manufacturing techniques, and methods of fashion promotion used in retail outlets. Field trip; see *Timetable* for approximate cost. Prerequisite: Advertising 281 and senior standing, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
410. **Problems in Family Living.** Family relationships and their significance to the growth of family members. Prerequisite: Home Economics 210. 1 unit.

418. **Seminar in Child Development.** Advanced problems in child development. Prerequisite: Home Economics 301. 1 unit.
419. **Seminar in Family Relationships.** Critical evaluation of research literature in the field of marriage and family relationships. Prerequisite: Home Economics 410. 1 unit.
422. **Seminar in Nutrition.** Study of recent literature in nutrition. Prerequisite: Undergraduate degree in home economics, with emphasis on foods and nutrition, or comparable background in biochemistry, microbiology, physiology, or other biological science. $\frac{1}{2}$ or 1 unit.
423. **Problems in Human Nutrition.** Methods of assessing nutritional status of humans. Prerequisite: Home Economics 324 or equivalent. $\frac{1}{2}$ or 1 unit. Offered in alternate years.
432. **Seminar in Foods.** Review of current literature in foods research. Prerequisite: Undergraduate major in foods and nutrition, chemistry, microbiology, or physiology; consent of instructor. $\frac{1}{2}$ or 1 unit.
457. **Sensorimotor Development.** Same as Physical Education 457. Study of the development of spatially adapted movement behavior in man; emphasis on the nature of sensorimotor systems and development of perception; the role of proprioceptive feedback mechanisms and associated reflexes; and the neurogeometric principles basic to the study of man interpreting and acting on the environment. Prerequisite: Physical Education 357, or equivalent. 1 unit.
470. **Seminar in Family and Consumption Economics.** Same as Agricultural Economics 470. Discussion of current topics and review of the literature in family and consumption economics. Prerequisite: Economics 101 or equivalent; a course in applied statistics; Home Economics 313 or 370, or consent of instructor. $\frac{1}{2}$ or 1 unit.
480. **Seminar in Textiles.** Current literature related to development in the production, use, and care of textile fabrics. Prerequisite: Home Economics 380 or equivalent; consent of instructor. $\frac{1}{2}$ or 1 unit.
487. **Seminar in Clothing.** Study and discussion of research in clothing from the aspects of psychological and sociological factors contributing to the effect of clothing on the development of individuals, and on family and community group reactions. Prerequisite: Undergraduate curriculum with majors in textiles and clothing, home economics education, home economics extension, or general home economics. $\frac{1}{2}$ or 1 unit.
493. **Advanced Studies in Home Economics.** Library or experimental research on specific problems of limited scope. Work may be taken in the following subjects: (a) child and family; (b) family and consumption economics; (c) family housing; (d) foods; (e) nutrition; and (f) textiles and clothing. May be taken in addition to 8 units required for a master's degree by students who do not write a thesis. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Work may be taken in the following subjects: (a) child development and family relationships; (b) family and consumption economics; (c) family housing; (d) foods; (e) nutrition; and (f) textiles and clothing. 0 to 4 units.

HORTICULTURE

Head of Department: Professor C. J. Birkeland
Department Office: 124 Mumford Hall, Urbana

100. **Introductory Horticulture.** Principles and practices involved in the production of fruits, vegetables, and ornamental plants. Lectures and discussions. Prerequisite: Botany 100. 3 hours.
110. **Plant and Animal Genetics.** Same as Agronomy, Animal Science, and Dairy Science 110. Principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111, or Botany 100 or 101. 3 hours.

122. **Greenhouse Management.** Principles of greenhouse operation, soils, fertilizers, potting, watering, and ventilating. Lectures, reference readings, and greenhouse practice. Prerequisite: Credit or concurrent registration in Botany 100. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
190. **Organic and Traditional Vegetable Gardening.** A comparison of the philosophy, scientific principles, and practices of organic and traditional methods of home vegetable gardening; designed primarily for nonagricultural majors. 3 hours. Credit will not be given to students in the ornamental horticulture curriculum, and only open elective credit will be given to students in other agricultural curricula.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Identification and Use of Woody Ornamental Plants, I.** Systematic approach to the identification, ornamental characters, culture, propagation, production, and use of woody ornamental deciduous trees and shrubs; special emphasis on the cultivated varieties. Prerequisite: Botany 100 or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
202. **Identification and Use of Woody Ornamental Plants, II.** Systematic approach to the identification, ornamental characters, culture, propagation, production and use of woody ornamental conifers, broadleaf evergreens, vines, ground covers and woody ornamental deciduous trees and shrubs; special emphasis on the cultivated varieties. Prerequisite: Botany 100 and Horticulture 201, or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
210. **Home Grounds Planning and Design.** Practice of developing home grounds; emphasis on analysis and practical solutions of typical site problems; and evaluation of plants and garden structures as elements in home grounds planning and design. Prerequisite: Horticulture 202, Landscape Architecture 152, or consent of instructor. 4 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only. Credit allowed toward fulfilling requirement in Group III, ornamental horticulture curriculum, only if Horticulture 211 is also completed.
211. **Home Grounds Development and Construction.** Continuation of Horticulture 210, with emphasis on development of home grounds and construction methods and techniques. Prerequisite: Horticulture 202 and 210, or consent of instructor. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
212. **Landscape Contracting.** Interpretation of the landscape architect's plans and specifications; estimating quantities of materials; and computing costs and procedures for bidding and executing landscape construction. Prerequisite: Horticulture 211. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
221. **Plant Propagation.** Principles, methods, and practices employed in the propagation of plants, emphasizing anatomical features and physiological principles involved in sexual propagation (seeds) and asexual propagation (division, cuttings, budding, grafting, etc.). Prerequisite: Botany 100 or equivalent. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agriculture occupations for secondary teachers curriculum only.
223. **Floricultural Crops Production, I.** Commercial production of major cut-flower crops in the greenhouse and field. Prerequisite: Horticulture 122. 3 hours. Offered in alternate years.
224. **Floricultural Crops Production, II.** Commercial production of pot plants and minor

- greenhouse and field-grown cut flowers. Prerequisite: Horticulture 223. 3 hours. Offered in alternate years.
225. **Ornamental Gardening.** Theory and practice of planting and maintaining ornamental plants in public and private landscaped areas; the functional use of ornamental woody plants, flowers, and turf in the landscape. Not open to students in the ornamental horticulture curriculum. 3 hours.
226. **Bedding and Foliage Plants.** Commercial production and use of tender ornamental plants (grown for outdoor bedding purposes), and of foliage plants (suitable for indoor decorative uses). Prerequisite: Horticulture 122 or Botany 100. 3 hours. Offered in 1974-75 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
230. **Garden Flowers.** The place of herbaceous flowers in the landscape and their cultural requirements and uses; the planning of perennial borders for continuous bloom; and survey of some of the genera contributing importantly to our flower gardens. Of value to nonfloriculture students interested in the home grounds. Prerequisite: Botany 100. 3 hours. Offered in 1974-75 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
231. **Floral Decorations.** Principles of design as applied to the composition and decorative use of flowers, foliages, and accessories. Prerequisite: Junior standing. 3 hours.
232. **Advanced Floral Decorations and Flower Shop Management.** Continuation of Horticulture 231. Flower shop management. Prerequisite: Horticulture 231. 3 hours. Offered in alternate years.
233. **Floriculture for the Home.** Fundamentals of home gardening and the effective use of ornamentals as a part of the home environment; subjects include the selection, culture, and use of garden annuals, biennials, perennials, bulbs, and house plants; garden tools and equipment; soil preparation; plant propagation; principles of design and planting methods; garden maintenance; use of fertilizers; pest control; training and pruning; lawn care; hybridizing; growing structures; and care of cut flowers. Not open to students in the ornamental horticulture curriculum. 3 hours.
234. **Nursery Management.** Study of the various practices and methods of operating a commercial nursery for the production of ornamental woody plants used in landscaping. Lectures, assigned reading, and laboratory exercises. Prerequisite: Botany 100. 3 hours. Offered in 1975-76 and in alternate years. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
236. **Turfgrass Management.** Principles and practices used in management of the turf grasses in areas of general and special use; of value to students interested in one or more aspects of turf grass utilization. Lectures, assigned readings, and laboratory exercises. Prerequisite: Botany 100. 3 hours.
242. **Vegetable Crops Production.** Introduction to the growth habits, soil and climatic requirements, culture, storage, varietal characteristics, and pests of vegetable crops. Prerequisite: Horticulture 100 or consent of instructor. 3 hours. Offered in alternate years.
251. **Arboriculture.** Principles in the care and maintenance of ornamental trees and shrubs in the established landscape; consideration of environmental factors, soils, nutrition, pruning, tree surgery, and insect and disease control. Prerequisite: Agronomy 101. 3 hours. Registration limited to horticulture majors, students in the ornamental horticulture curriculum, or students in the agricultural occupations for secondary teachers curriculum only.
262. **Fruit Science, I.** Technological application of biological principles to the culture of temperate fruit plants. Prerequisite: Botany 100. 3 hours. Offered in alternate years.
300. **Special Problems.** Supervised research on individual problems in any phase of horticulture; includes anatomy, breeding, physiology, ecology, or general culture of fruit, vegetable, or ornamental plants. Prerequisite: Not open to students on probation; written

consent of the instructor and authorized departmental approval required prior to advanced enrollment and registration. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.

307. **International Food Crops.** Same as Plant Pathology 307. Various international food crops studied; production and problems created by diseases and insects emphasized; tropical and subtropical crops stressed; temperate food crops of international importance included; and ecological factors affecting fundamentals of food crop production and plant protection examined. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
321. **Floricultural Physiology.** Study of the physiology and metabolism of floricultural crops during their development from seeds through flowering. Lectures and discussion. Prerequisite: Agronomy 101, Botany 100, or consent of instructor. 4 hours or 1 unit.
322. **Plant Nutrition.** Study of the mechanisms of and factors affecting the absorption, transport, and functions of the essential elements required by higher plants. Lectures, discussions, and laboratory. Prerequisite: Agronomy 101; Botany 234 or 330, or consent of instructor. 4 hours or 1 unit.
323. **Principles of Plant Breeding.** Same as Agronomy 323. Genetic and cytological variation in crop plants; the production and control of such variation in developing varieties and hybrids; and the maintenance of high quality seed stocks. Field trips; see *Timetable* for approximate cost. Prerequisite: Agronomy 110 or equivalent; Botany 100. 4 hours or 1 unit.
333. **Plant Physiology Laboratory.** Same as Agronomy 333 and Botany 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.
335. **Economics of Food Distribution.** Same as Agricultural Economics 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; and (c) consumer demand for food. Prerequisite: Economics 101; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
345. **Growth and Development of Horticultural Crops.** Factors affecting growth, development, and quality of horticultural crops, such as photoperiodism, growth regulators, carbon dioxide levels, etc. Lecture and discussion. Prerequisite: One year of general chemistry and one semester of general or plant physiology, or consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Entomology 361 and Zoology 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit.
398. **Postharvest Physiology of Horticultural Crops.** Physiology, biochemistry, and anatomy of fruits and vegetables during development, maturation, and ripening *in situ* and in storage. Prerequisite: Botany 100 and Chemistry 102 or 103, or equivalent. 4 hours or 1 unit.
424. **Mineral Nutrition of Plants.** Same as Agronomy 424 and Botany 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants; the essentiality of various anions and cations in the light of metabolic activity and constituency in func-

tional plant compounds; and major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.

431. **Plant Cell Metabolism.** Same as Agronomy, Biology, Forestry, and Plant Pathology 431. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the biochemistry of mature seeds and metabolic processes occurring during seed germination and heterotrophic growth. Meets during the first half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
432. **Plant Cell Energetics.** Same as Agronomy, Biology, Forestry, and Plant Pathology 432. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the energy coupling processes in plant cells (respiration, photosynthesis, photorespiration); and discusses current literature relating to mechanisms of electron transport, phosphorylation, and carbon fixation. Meets during the second half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
433. **Environmental Regulation of Plant Growth.** Same as Agronomy, Biology, Forestry, and Plant Pathology 433. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns mechanisms of plant response to the environment, including ion uptake and transport, water relationships, gas exchange, and photosynthesis of whole plants. Meets during the first half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
434. **Regulation of Plant Development and Reproduction.** Same as Agronomy, Biology, Forestry, and Plant Pathology 434. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the hormonal regulation of growth, development, and reproduction and the metabolism of seed and fruit formation. Meets during the second half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Horticulture 340 or equivalent. $\frac{3}{4}$ unit.
447. **Horticulture Seminar.** Discussion of current research and literature pertaining to problems of horticulture and related fields. Prerequisite: Graduate standing in horticulture or related fields. $\frac{1}{4}$ unit.
488. **Plant Pigments.** Same as Botany 488. A comprehensive presentation of the nature, function, distribution, biosynthesis, degradation, separation, and spectroscopic properties of pyrrole, carotenoid, quinone, and anthocyanin pigments. Prerequisite: Botany 330 or consent of instructor. 1 unit. Offered in alternate years.
490. **Research Methods in Horticulture.** Lectures, discussions, demonstrations, and laboratory exercises dealing with methods and apparatus used in horticultural research. Prerequisite: One year of general chemistry and one semester of general or plant physiology, or consent of instructor. 1 unit.
492. **Special Topics in Horticulture.** Readings and discussion in selected phases of horticulture including such topics as genetics, physiology, anatomy, morphology, and ecology of horticultural crops. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and 12 hours for a minor. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** Research on problems in floriculture, fruit breeding, pomology, and vegetable crops. Required in horticulture major. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and 12 hours for a minor. 0 to 4 units.

HUMANITIES, SCHOOL OF

(Including Classics, Comparative Literature, English, French, Germanic Languages and Literatures, History, Humanities, Linguistics, Philosophy, Religious Studies, Slavic Languages and Literatures, Spanish, Italian, and Portuguese, and Speech Communication)

Director of School: Professor N. Baym

School Office: 210 Lincoln Hall, Urbana

Classics

(Including Classical Archaeology, Classical Civilization, Coptic, Greek, Latin, and Modern Greek)

Head of Department: Professor M. Marcovich

Department Office: 4072 Foreign Languages Building, Urbana

CLASSICAL ARCHAEOLOGY

The following courses presuppose no knowledge of the Greek and Latin languages and are open to all students.

331. **The Archaeology of Greece.** Monuments and material remains illustrating the development of Greek civilization to 323 B.C. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **The Archaeology of Italy.** Monuments and material remains illustrating the development of Graeco-Roman and other ancient Italian civilizations to 330 A.D. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
433. **The Archaeology of Magna Graecia and Sicily.** Problems in the archaeology of Magna Graecia and Sicily. Prerequisite: Classical Archaeology 331 and 332, or equivalent. 1 unit.
435. **Field Work.** Participation in archaeological excavation; discussion of methods and procedures and practice in actual working conditions. Prerequisite: Consent of instructor. 1 unit.

CLASSICAL CIVILIZATION

The following courses presuppose no knowledge of the Greek and Latin languages and are open to all students. For other courses in the area of classical civilization, see Architecture 211 and 310; Art and Design 217, 218, 301, 303, 304, and 305; Classical Archaeology 331 and 332; History 181, 182, 381, 382, 383, and 384; Philosophy 303, 309, and 310; Political Science 393; and Religious Studies 201, 202, 210, and 340.

100. **Vocabulary Building from Greek and Latin Roots.** Vocabulary building assistance for students through an analysis of Greek and Latin roots, prefixes, and suffixes found in English. 2 hours.
110. **Introduction to Greek Culture.** Study of social and cultural life in Greece during the classical period. 2 hours.
111. **Mythology of Greece and Rome.** A study of the major myths of Greece and Rome and their impact upon later art, music, and literature. 2 hours.

112. **The Roman Achievement.** Introduction to Roman civilization through the study of the social and cultural life of ancient Rome. 2 hours.
150. **Sports in Greece and Rome.** Athletics and sports in ancient Greece and Rome from 776 B.C. to 393 A.D. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Greek Literature in Translation.** Introduction to Greek literature, from Homer to the Hellenistic age, and its cultural and historical background. 3 hours.
202. **Latin Literature in Translation.** Introduction to Latin literature of the classical period and to its cultural and historical background. 3 hours.
221. **The Heroic Tradition.** Study of ancient epics and their relation to the social consciousness of their period; introductory and background lectures; and readings in the epic tradition of antiquity and its successors. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
222. **The Tragic Spirit.** Readings in the tragic drama of Greece and Rome: a systematic study of the contents and development of this classical literary/dramatic genre. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
315. **Greek, Roman, and Medieval Rhetorical Theory.** Same as Speech Communication 315. Examination of the development of rhetorical theory, criticism, and pedagogy in Western thought; an analysis of the contribution of major figures and works from Homer to the Renaissance. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Graduate students registered for 1 unit will be expected to do additional work.
331. **Satire and Social Criticism.** Same as Comparative Literature 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in the Greek old comedy and Roman satire, or by suggesting escape, as in the new comedy of manners and the prose romances; some attention to the tradition of satire in medieval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
332. **The Ancient Ideal in Art and Literature.** Study of the aesthetic standards and theories of the Graeco-Roman world and the ways in which these ideals are expressed in the literature, art, and architecture of antiquity. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
347. **The Age of Charlemagne.** Same as History 347. The Age of Charlemagne and its intellectual, political, social, and cultural significance for Western civilization. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
382. **Language Laboratory Techniques.** Same as English as a Second Language, French, German, Humanities, Slavic, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
390. **Topics in Classical Literature.** Study of selected topics in Greek and Latin literature in translation; content is variable. Prerequisite: Classical Civilization 201 or 202, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
391. **Aspects of Greek and Roman Civilization.** Study of selected aspects of Greek and Roman civilization by treating particular topics as they appear in both civilizations; content is variable. Prerequisite: Classical Civilization 110 and 112, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.

COPTIC

301. **Introductory Coptic, I.** Same as Religious Studies 301. Introduction to the principles of Coptic grammar and to the reading of biblical and gnostic texts. A knowledge of classical or koine Greek, though useful, is not required. 3 hours or $\frac{3}{4}$ unit.

302. **Introductory Coptic, II.** Same as Religious Studies 302. Continuation of Coptic/Religious Studies 301; reading of gnostic and postbiblical texts. Prerequisite: Coptic/Religious Studies 301. 3 hours or $\frac{3}{4}$ unit.

GREEK

101. **Elementary Greek.** Introduction to the fundamentals of classical Greek, including the reading of simple prose. 4 hours.
102. **Elementary Greek.** Continuation of Greek 101. Grammar and reading. Prerequisite: Greek 101 or equivalent. 4 hours.
111. **Elementary Koine Greek.** Same as Religious Studies 111. Introduction to the fundamentals of Koine Greek, including reading from the New Testament. 4 hours.
112. **Elementary Koine Greek.** Same as Religious Studies 112. Continuation of Greek 111. Grammar and reading. Prerequisite: Greek 111 or equivalent. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Intermediate Koine Greek.** Same as Religious Studies 200. Reading of narrative and epistolary New Testament Greek. Prerequisite: Greek 112 or equivalent. 4 hours.
201. **Second-Year Greek.** Reading of Attic prose. Prerequisite: Greek 102 or equivalent. 4 hours.
202. **Second-Year Greek.** Continuation of Greek 201. Introduction to epic Greek; reading of Homer. Prerequisite: Greek 201 or equivalent. 4 hours.
292. **Senior Thesis.** Open to candidates for distinction in Greek. Prerequisite: Senior standing. 2 to 4 hours.
298. **Senior Survey.** Thesis and honors. For candidates for honors in Greek and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
301. **Third-Year Greek.** Readings in Attic prose. Prerequisite: Greek 202. 3 hours or $\frac{1}{2}$ unit.
302. **Third-Year Greek.** Continuation of Greek 301. Readings in Greek tragedy. Prerequisite: Greek 301. 3 hours or $\frac{1}{2}$ unit.
308. **Comparative Grammar of Greek and Latin.** Same as Latin 308 and Linguistics 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or $\frac{3}{4}$ unit.
309. **The Structure of Greek and Latin.** Same as Latin 309 and Linguistics 311. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Credit or concurrent registration in Greek 202 and Latin 202, or their equivalent. 3 hours or $\frac{3}{4}$ unit.
310. **Introduction to Indo-European Linguistics.** Same as Latin 310 and Linguistics 309. Introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction; principles of comparative phonology and introductory survey of morphology; and discussion of theories about the original home, culture, and society of the Indo-Europeans. Prerequisite: Fulfillment of the language requirement of the College of Liberal Arts and Sciences. 3 hours or 1 unit.
311. **Greek Prose Composition.** Practice in the writing of Greek prose. Prerequisite: Greek 201 or equivalent. 3 hours or $\frac{3}{4}$ unit.
312. **Sight Translation.** Exercise in the sight translation of passages of Greek authors. Prerequisite: Greek 202 or equivalent. 3 hours or $\frac{3}{4}$ unit.
371. **The Gospels.** Same as Religious Studies 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
391. **Readings in Greek Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Greek. Prerequisite: Greek 302 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
411. **Hellenistic Literature (Proseminar).** Study primarily of post classical poetry in the

- context of cultural and literary developments between the fourth century B.C. and the first century A.D. Prerequisite: Greek 391 or equivalent. 1 unit.
413. **Greek Lyric Poetry (Proseminar).** Study of one or more lyric poets with emphasis on the background and the particular literary achievement of the poet(s) chosen. Prerequisite: Greek 391 or equivalent. 1 unit. May be repeated for credit.
415. **Homer (Proseminar).** Textual, metrical, and literary analysis of the *Iliad* and the *Odyssey*, and their transmission; select problems in Homeric scholarship. Prerequisite: Greek 391 or equivalent. 1 unit.
416. **Thucydides (Proseminar).** Study of Thucydides' historical method in conjunction with the literary merits of his work and the problems of its composition. Prerequisite: Greek 391 or equivalent. 1 unit.
420. **Plato (Proseminar).** Life, writings, and philosophy of Plato; transmission of the *Corpus Platonicum*; reading and philosophical analysis of select dialogues. 1 unit.
424. **Greek Drama: Tragedy (Proseminar).** Textual, metrical, and literary analysis of the extant plays of Aeschylus, Sophocles, or Euripides, and their transmission and significance. Prerequisite: Greek 391 or equivalent. 1 unit. May be repeated as topic varies.
425. **Greek Drama: Comedy (Proseminar).** Textual, metrical, and literary analysis of the extant comedies of Aristophanes or Meander, including their transmission and significance. Prerequisite: Greek 391 or equivalent. 1 unit.
440. **Papyrology.** Introduction to the editing of Greek papyri; students work on both published and unpublished material. Prerequisite: Greek 302. 1 unit.
441. **Greek Palaeography.** History and development of Greek writing from the third century B.C. to the end of the fifteenth century A.D. Prerequisite: Three years of college Greek. 1 unit.
460. **Studies in Patristic Greek Literature (Seminar).** Aspects of the religious and social history of early Christianity on the basis of Greek Patristic texts. Prerequisite: Three years of college Greek. 1 unit.
480. **Greek Seminar.** Research on special problems of Greek literature; required of all majors in classical philology. Prerequisite: A Greek proseminar. 1 unit.
493. **Independent Reading.** Prerequisite: Consent of the student's advisor and of the instructor. $\frac{1}{4}$ to 2 units. May be repeated but no more than 1 unit of credit may be applied toward the minimum requirement for the M.A. degree, and no more than 2 units of credit may be applied toward the minimum requirement for the Ph.D. degree.
495. **Bibliography and Criticism.** Same as Latin 495. Introduction to the methods and techniques of scholarship. Prerequisite: Three years of college Greek. $\frac{1}{2}$ unit.
496. **Bibliography and Criticism.** Same as Latin 496. Continuation of Greek/Latin 495. Prerequisite: Greek or Latin 495. $\frac{1}{2}$ unit.
499. **Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

LATIN

101. **Elementary Latin.** Grammar and reading for students who have had no work in Latin. 4 hours.
102. **Elementary Latin.** Grammar and reading of easy prose. Prerequisite: Latin 101 or one year of high school Latin. 4 hours.
103. **Intermediate Latin.** Review of grammar; reading of easy narrative prose. Prerequisite: Latin 102 or two years of high school Latin. 4 hours.
104. **Introduction to Latin Literature.** Continuation of Latin 103, with readings chiefly in Latin poetic literature. 4 hours.
105. **Intensive Elementary Latin.** Equivalent to Latin 101 and 102. Introduction to basic grammar and syntax for students who have had no previous Latin and want to learn at a rapid rate; use of computer-assisted individual mastery lessons. 8 hours.
106. **Intensive Intermediate Latin.** Equivalent to Latin 103 and 104. Review of grammar and syntax and reading of easy prose and poetry for students who have attained 102

proficiency and wish to advance more rapidly; use of computer-assisted program materials. Prerequisite: Latin 102 or 105, or a placement score showing high school achievement equivalent to Latin 102. 8 hours.

113. **Latin Composition.** Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Credit or concurrent registration in Latin 103 or three years of high school Latin. 2 hours.
114. **Latin Composition.** Continuation of Latin 113. Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Latin 113. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Survey of Latin Literature.** The republican period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
202. **Survey of Latin Literature.** The imperial period. Prerequisite: Latin 104 or four years of high school Latin. 3 hours.
203. **Cicero and the Roman Republic.** Study of the political writings of Cicero, emphasizing the events of his consular year. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
204. **Vergil and the Augustan Age.** Study of the poetry of Vergil emphasizing the ancient epic as a literary genre and as the historical background to the *Aeneid*. Prerequisite: Latin 201 and 202, or equivalent. 3 hours.
280. **Teachers' Course.** Introduction to the problems of the teaching of Latin and a study of textbooks. Required of teacher-training majors in Latin. This course will not meet during the six-week student teaching period. Prerequisite: Latin 202; senior standing. 4 hours.
292. **Senior Thesis.** Thesis and honors. For candidates for honors in Latin and for other seniors. Prerequisite: Senior standing. 2 or 4 hours.
298. **Senior Survey.** Thesis and honors. For candidates for honors in Latin and for other seniors. 2 or 4 hours.
308. **Comparative Grammar of Greek and Latin.** Same as Linguistics 308 and Greek 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or $\frac{3}{4}$ unit.
309. **The Structure of Greek and Latin.** Same as Greek 309 and Linguistics 311. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Credit or concurrent registration in Greek 202 and Latin 202, or their equivalent. 3 hours or $\frac{3}{4}$ unit.
310. **Introduction to Indo-European Linguistics.** Same as Greek 310 and Linguistics 309. Introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction; principles of comparative phonology and introductory survey of morphology; and discussion of theories about the original home, culture, and society of the Indo-Europeans. Prerequisite: Fulfillment of the language requirement of the College of Liberal Arts and Sciences. 3 hours or 1 unit.
311. **Intermediate Prose Composition.** Practice in the writing of Latin prose. Prerequisite: Latin 114 or equivalent. 3 hours or $\frac{3}{4}$ unit.
312. **Advanced Composition.** Practice in the writing of Latin prose. Prerequisite: Latin 114 or equivalent. 3 hours or $\frac{3}{4}$ unit.
313. **Oral Latin.** Introduction to the use of Latin as a means of oral communication, with particular reference to instruction in secondary schools. Offered in summer session only. Prerequisite: Latin 312 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
361. **Medieval Latin.** Literary and historical texts in prose and poetry from Cassiodorus to Roger Bacon. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
391. **Readings in Latin Literature.** Readings in authors or special topics chosen by the instructor from the entire extant literature in Latin. Prerequisite: Three years of college

- Latin or equivalent; consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.
400. **Beginning Latin for Graduate Students.** Basic grammar, syntax, and vocabulary; reading practice. Designed for graduate students who need to use Latin in their research. 4 hours. No graduate credit.
 401. **Readings in Latin for Graduate Students.** Directed readings, largely in medieval and modern Latin. Designed for graduate students who need to use Latin in their research. Prerequisite: Latin 400 or two years of high school Latin, or equivalent. 4 hours. No graduate credit.
 402. **Teaching College Latin.** Designed for new graduate teaching assistants in the Classics Department; examination of new techniques for teaching pronunciation, vocabulary, grammar, and the reading of Latin; closely correlated with the teaching assignments of the graduate students. May not be counted toward 400 level requirement in Latin. $\frac{1}{4}$ unit.
 409. **History of the Latin Language.** Development of sounds, forms, syntax, and stylistics from the earliest times through the classical, medieval, and early modern periods; reading and discussion of selected documents, literary and otherwise. Prerequisite: Two years of college Latin or equivalent; two years of modern foreign language. 1 unit.
 411. **Latin Epigraphy.** Inscriptions studied as evidence for both the structure of Roman society and the evolution of Latin. Prerequisite: Three years of college Latin or equivalent; one year of ancient history. 1 unit.
 412. **Latin Elegy (Proseminar).** Critical study of Tibullus or Propertius or selected major works of Ovid. Prerequisite: Latin 391 or equivalent. 1 unit.
 414. **Lucan (Proseminar).** Critical study of the historical significance and text of his epic. Prerequisite: Latin 391 or equivalent. 1 unit.
 415. **Lucretius (Proseminar).** Study of the *De Rerum Natura* with emphasis on philosophical context, philological and literary problems, and Lucretius' relationship to his poetic and philosophical predecessors. Prerequisite: Latin 391 or equivalent. 1 unit.
 416. **Vergil (Proseminar).** Examination of Vergil's place in the development of the Latin poetic tradition with particular emphasis on the literary background of the *Aeneid*. Prerequisite: Latin 391 or equivalent. 1 unit.
 421. **Horace (Proseminar).** The satires, epistles, and lyric poems of Horace and the beginnings of literary criticism. Prerequisite: Latin 391 or equivalent. 1 unit.
 422. **Roman Comedy (Proseminar).** Selected plays of Plautus and Terence; Italian and New Attic comedy. Prerequisite: Latin 391 or equivalent. 1 unit. May be repeated for credit.
 425. **Cicero (Proseminar).** Study of Cicero's life and literary activities. Prerequisite: Latin 391 or equivalent. 1 unit.
 427. **Roman Satire (Proseminar).** Development of formal satire, concentrating on Horace, Juvenal, and the Apocolocyntosis of Seneca; some consideration of Catullus, Persius, Martial, and Petronius. Prerequisite: Latin 391 or equivalent. 1 unit.
 430. **The Roman Historians (Proseminar).** Selections from one or more of the following, with reference to specific literary and historical topics: Caesar, Sallust, Livy, Tacitus, and Ammianus Marcellinus. Prerequisite: Latin 391 or equivalent, or consent of instructor. 1 unit. May be repeated as topic varies.
 441. **Latin Palaeography.** History of the Latin script from the Romans to the national hands of western Europe. Prerequisite: Latin 391 or equivalent, or consent of instructor. 1 unit.
 461. **The Medieval Latin Bible (Seminar).** Study of the Vulgate and earlier Latin versions of the Bible and of the commentaries of the Latin Fathers. Prerequisite: Latin 361 or 391, or equivalent. 1 unit.
 462. **The Carolingian Renaissance (Seminar).** Same as Comparative Literature 454. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. Prerequisite: Latin 361 or 391, or equivalent. 1 unit.

480. **Latin Seminar.** Research on special problems of Latin literature; required of all concentrators in classical philology. Prerequisite: A Latin proseminar. 1 unit.
493. **Independent Reading.** Prerequisite: Consent of the student's adviser and of the instructor. $\frac{1}{4}$ to 2 units. May be repeated but no more than 1 unit of credit may be applied toward the minimum requirement for the M.A. degree, and no more than 2 units of credit may be applied toward the minimum requirement for the Ph.D. degree.
495. **Bibliography and Criticism.** Same as Greek 495. Introduction to the methods and techniques of scholarship. Prerequisite: Latin 391 or equivalent. $\frac{1}{2}$ unit.
496. **Bibliography and Criticism.** Same as Greek 496. Continuation of Greek/Latin 495. Prerequisite: Greek/Latin 495. $\frac{1}{2}$ unit.
499. **Thesis Research.** Guidance in writing theses for advanced degrees. 0 to 4 units.

MODERN GREEK

201. **Elementary Modern Greek, I.** An introduction to Modern Greek, in its spoken and written forms, including the elements of formal grammar. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Modern Greek, II.** Second term of spoken Modern Greek; formal grammar based on graded lesson materials; and work in written Greek. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Greek 201. 5 hours.
303. **Intermediate Modern Greek, I.** First term of second year of work in Modern Greek; drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; increasing study of the written language; and more formal grammar. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Modern Greek, II.** Continuation of Modern Greek 303. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 303 or equivalent. 5 hours or 1 unit.

Comparative Literature

Director of Graduate Program: Professor F. J. Jost

Office: 2070 Foreign Languages Building, Urbana

203. **Goethe in Translation.** Same as German 203. Introduction to the life and works of Johann Wolfgang von Goethe; focus on his poetic work and treatment of his major contributions to science as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as German 204. German medieval precourtly and courtly literature in the European context; readings in the works of Hartmann von Aue, Gottfried von Strassburg, Wolfram von Eschenbach, and others, including the following epics: *Nibelungenlied*, *Gregorius*, *Tristan*, and *Parzival*. 3 hours.
313. **The Divine Comedy.** Same as Italian 313. Interpretation of Dante's *Divine Comedy* with special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or $\frac{1}{2}$ unit.
331. **Satire and Social Criticism.** Same as Classical Civilization 331. Reading and discussion of literary documents which question current social values, either by ridiculing personal traits and social trends, as in Greek old comedy and Roman satire, or by suggesting escape, as in the new comedy of manners and the prose romances; some attention to the tradition of satire in medieval and modern literature. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

359. **The International Folk Tale.** Same as English 367. Study of the origin, distribution, and nature of the folk tale. 3 hours or $\frac{3}{4}$ unit.
363. **Introduction to Comparative Literature, I.** One-year course in two parts, offering a survey of methods and goals of comparative literature illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or $\frac{3}{4}$ unit.
364. **Introduction to Comparative Literature, II.** Continuation of Comparative Literature 363. 3 hours or $\frac{3}{4}$ unit.
370. **Vladimir Nabokov.** Same as Russian 370 and English 370. The major contribution of Vladimir Nabokov to world literature. No knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
387. **Introduction to Myth and Folklore.** Same as English, German, Slavic and Speech Communication 387. Prerequisite: One year of college literature, or consent of instructor; reading knowledge of one modern foreign language recommended. 3 hours or $\frac{3}{4}$ unit.
396. **Special Topics in Comparative Literature.** Selected literary topics of international significance in relation to other cultural expressions. Prerequisite: Consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit. May be repeated for a maximum of six hours or two units.
401. **Theory of Literature.** Methods and objectives of the discipline of comparative literature. Prerequisite: Reading knowledge of two foreign languages; consent of instructor. 1 unit.
415. **Dostoevsky.** Same as Russian 415. Dostoevsky: historical background, textual analysis, structure, philosophy, artistic evaluation, and influence on French, English, American, and German literatures. 1 unit.
419. **Tolstoy.** Same as Russian 419. Tolstoy: historical background, textual analysis, structure, philosophy, aesthetic evaluation, and influence on French, English, American and German literatures. 1 unit.
420. **Chekhov.** Same as Russian 420. Chekhov: historical background, textual analysis, structure, philosophy, artistic evaluation, and interrelationship with English, French, German (and Scandinavian), and American literatures. 1 unit.
431. **Comparative Slavic Literature.** Same as Slavic 431. Survey of Slavic literature, especially Czech, Polish, and Yugoslav, and their connection with Russian and Western traditions. 1 unit.
441. **Naturalism, Symbolism, and Expressionism.** Same as German 451. Comparative analysis of German literature from the 1880s to the 1920s within the European context. 1 unit.
451. **Seminar in Literary Movements and Periods.** Investigation of the development and mutation of literary movements (classicism, romanticism, symbolism, etc.) through a study of critical texts and their reception in various countries. The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.
452. **Seminar in Romantic Literature.** Same as English 433. Prerequisite: A college course devoted entirely to an aspect of Romantic studies, or consent of instructor. 1 unit. May be repeated as topic varies.
454. **The Carolingian Renaissance.** Same as Latin 462. Study of the Latin literature of the Carolingian period with emphasis on the work of Alcuin and Charlemagne. Prerequisite: Latin 361 or 391, or equivalent. 1 unit.
461. **Seminar in Literary Genres and Forms.** Same as German 462. Study of a form (the lyric, the novel, the drama, etc.) to discover its essential components in all the literatures studied and the significance of national variations. 1 unit. May be repeated to a maximum of 3 units as topic varies.
462. **Seminar in Spanish-American Novel.** Same as Spanish 436. Special problems in methodology and research, including other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit.
471. **Seminar in Literary Relations.** Investigation of the impact of one literature upon another, or of some specific works upon others (the role of English literature in continen-

tal Europe, the influence of Russian novelists on French and German writers, etc.). The subject of the seminar varies each semester; may be taken more than once for a total of 3 units. 1 unit.

472. **Studies in French and Comparative Cinema.** Same as French 452. Historical, aesthetic, social, and technical studies of the French cinema and its development and relation to world cinema and to literature. 1 unit. May be repeated to a maximum of 3 units credit.
473. **Seminar in French and Comparative Cinema.** Same as French 482. Study of several major French directors within the context of French and international cinema; comparison with selected non-French directors; and the relationship of films to other literary forms. 1 unit.
478. **Seminar in Twentieth-Century French Literature.** Same as French 478. Discussion and research on some specialized topic in twentieth-century French literature. See *Timetable* for current topics. 1 unit. May be repeated for credit.
481. **Seminar in Literary Themes and Types.** Study of a theme or type (the Faust myth, the romantic hero, etc.) to discover its essential components in all the literatures studied and the significance of national variations. The subject of the seminar varies each semester. May be repeated to a maximum of 3 units. 1 unit.
482. **Seminar in Modern German Literature.** Same as German 461. Topics range from the Enlightenment to the present. Prerequisite: German 411 and 495. 1 unit. May be repeated as topics vary.
493. **Special Studies.** $\frac{1}{4}$ to 1 unit.
499. **Thesis Research.** Intended for students engaged in writing a thesis as a partial requirement for the M.A. or Ph.D. degree in comparative literature. Maximum credit for master's candidates is 2 units. 0 to 4 units.

English

(Including Business and Technical Writing and Rhetoric and Composition)

Head of Department: Professor G. Hendrick

Department Office: 100 English Building, Urbana

BUSINESS AND TECHNICAL WRITING

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
251. **Business and Administrative Communication.** Study of communication as a tool of administration and management; practice in writing a wide variety of types and forms of communication; and inclusion of oral and visual communication with the written to provide an integrated approach. For the student whose career will be in administration and management requiring a broad range of communication skills. Prerequisite: Completion of campus rhetoric requirement and sophomore standing. 3 hours.
271. **Sales Writing.** Same as Advertising 288. Direct mail campaigns and company magazine copy. Prerequisite: Sophomore standing. 3 hours.
272. **Report Writing.** Personal direction in a report writing project which can be integrated with research in another course; study of report-writing principles and practices. Classes meet for the first month after which the student and the instructor arrange a conference schedule. Small group meetings are arranged for presentation of proposals, progress reports, and summary reports. Prerequisite: Completion of campus rhetoric requirement and sophomore standing. 3 hours.
290. **Individual Study.** Independent research with a chosen tutor leading to the writing of a formal report or preparation of some other type of major presentation of information. Prerequisite: Completion of campus rhetoric requirement and sophomore standing. 3 hours.

ENGLISH

101. **Introduction to Poetry.** Reading and discussion of representative poems of several periods and types. 3 hours.
102. **Introduction to the Drama.** Reading and discussion of representative plays of several periods and types. 3 hours.
103. **Introduction to Fiction.** Reading and discussion of representative fiction of several periods and types. 3 hours.
104. **Introduction to Film.** Understanding of narrative films through the viewing and discussion of a representative body of film classics drawn from the entire range of world cinema; emphasizes the basic elements of cinematic expression, and concerns major movements, periods, and genres. 3 hours.
106. **Literature and Experience.** Understanding of the relationship between literature and human experience through the study of significant, recurrent themes. 3 hours. May be repeated to a total of 6 hours.
115. **Masterpieces of English Literature.** Study of selected major writings. 3 hours.
116. **Masterpieces of American Literature.** Study of selected major writings. 3 hours.
180. **Drama in Production.** Study, discussion, and production of a dramatic text. 3 hours.
198. **Freshman Honors Seminar.** Introduction to the study of literature, with emphasis on individual work in fundamental problems of literary analysis; works studied are usually a combination either of short poems and short stories or of novels and plays. Prerequisite: James Scholar standing or other designation as a superior student. 4 hours. May be repeated once as topics vary.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
202. **Medieval Literature and Culture.** British and continental authors (including Chaucer) read in modern English. Prerequisite: Sophomore standing or consent of instructor. 3 hours.
204. **Renaissance Literature and Culture.** Readings in English and continental literary masterpieces with attention to the significant cultural influences of the period. 3 hours.
205. **Introduction to Shakespeare.** 3 hours.
206. **Literature and Culture of the Enlightenment.** Readings in English and continental literature of the eighteenth century, with attention to significant cultural influences. 3 hours.
207. **Nineteenth-Century Literature and Culture.** English and continental literature of the nineteenth century, with attention to major intellectual and social movements. 3 hours.
209. **English Literature from the Beginning to 1798.** Historical and critical study of selected works of English literature to 1798 in chronological sequence. 3 hours.
210. **English Literature from 1798 to Present.** Historical and critical study of selected works of English literature after 1798 in chronological sequence. 3 hours.
240. **The English Romantic Poets.** Wordsworth, Scott, Coleridge, Byron, Shelley, and Keats. 3 hours.
241. **The Beginnings of Modern Poetry.** American and British poets including Frost, Robinson, Sandburg, Lindsay, Hardy, Hopkins, Housman, Yeats, Lawrence, the Imagists, and the early Pound and Eliot. 3 hours.
242. **Poetry Since 1940.** 3 hours.
243. **Development of the Modern Drama.** Ibsen to O'Neill. 3 hours.
244. **Development of the Modern Drama.** Pirandello to the present. 3 hours.
245. **The Short Story.** Historical and critical study of the short story (American and European) from the early nineteenth century to World War I; major emphasis on such authors as Hawthorne, James, Crane, Gogol, Chekhov, Maupassant, Flaubert, Joyce, and Mansfield. Prerequisite: One course in English or American literature. 3 hours.
246. **The Short Story.** Historical and critical study of the short story (American and European) from World War I to the present; major emphasis on such authors as Anderson, Hemingway, Faulkner, Porter, Kafka, Mann, Maugham, Lawrence, Salinger, and Camus. Prerequisite: One course in English or American literature. 3 hours.

247. **The British Novel.** Critical study of representative British novels from different literary periods. 3 hours.
248. **The European Novel.** Thematic interrelationships and contemporary relevance of such writers as Gogol, Turgenev, Dostoevsky, Flaubert, Tolstoy, Zola, Mann, Hesse, Kafka, and Camus. 3 hours.
249. **The American Novel.** Study of major and representative novels from the beginnings to the present. 3 hours.
255. **Survey of American Literature, I.** American literature and its cultural backgrounds to 1900. 3 hours.
256. **Survey of American Literature, II.** American literature and its cultural backgrounds in the twentieth century. 3 hours.
259. **Afro-American Literature, I.** Historical and critical study of Afro-American literature in its social and cultural context from the beginning to 1915. 3 hours.
260. **Afro-American Literature, II.** Historical and critical study of Afro-American literature in its social and cultural context since 1915. 3 hours.
273. **Film as Literature.** Critical study of narrative films, with viewing and discussion of a major film each week; in-depth study of selected directors, genres, and themes; emphasis on aspects of film aesthetics, criticism, and history. Prerequisite: English 104 or a college-level course in literature or film. 3 hours.
274. **Literature in Its Cultural Contexts.** Studies of literature from the point of view of other disciplines. See *Timetable* for current topics. 3 hours.
275. **Literature and Psychology.** Psychological and psychoanalytical theories in their bearings on the interpretation of literature. 3 hours.
277. **Modern Literary Criticism.** Important modern theories and methods of literary criticism and their relations to the study of literary texts. 3 hours.
290. **Individual Study.** Study of selected topics. Prerequisite: Consent of instructor. 0 to 3 hours. May be repeated for a total of 6 hours. Students may register in this course more than once in the same term.
291. **Honors Individual Study.** Study of selected topics. Restricted to English and English education concentrators with a 4.25 average who are working towards the degree with Distinction in English or in English education. Enrollment in appropriate honors office necessary. Prerequisite: Consent of English honors or English education honors adviser. 1 to 3 hours. May be repeated to a maximum of 6 hours.
293. **Honors Senior Thesis.** Independent research with a chosen tutor leading to the writing of a thesis. Candidates for distinction in English must take either English 290 or English 293; they may take both. Restricted to English or English education majors with a 4.25 average who have satisfied all other requirements towards the degree with distinction; enrollment in the English Honors Office necessary. 3 hours.
296. **Honors Seminar, I: Themes, Movements, and Forms in British and American Literature.** Restricted to English, rhetoric, and English education concentrators with a grade-point average of 4.25; enrollment through the English Honors Office necessary. Offered every semester with varying topics; may be repeated as topic varies. 3 hours.
297. **Honors Seminar, II: Periods in British and American Literature.** Restricted to English, rhetoric, and English education concentrators with a grade-point average of 4.25; enrollment through the English Honors Office necessary. Offered every semester with varying topics; may be repeated as topic varies. 3 hours.
298. **Honors Seminar, III: Major British and American Authors.** Each seminar considers one or two major authors. Restricted to English, rhetoric, and English education concentrators with a grade-point average of 4.25; enrollment through the English Honors Office necessary. May be repeated as topic varies. 3 hours.
301. **Introduction to the Study of the English Language.** Language theories and modes of language study applied to English. 3 hours or 1 unit.
302. **Descriptive English Grammar.** Same as English as a Second Language 302. 3 hours or 1 unit.

303. **Historical Introduction to the English Language.** Credit is not given for both English 303 and 403. 3 hours or 1 unit.
311. **Chaucer.** A selection read in Middle English. 3 hours or 1 unit.
315. **Poetry and Prose of the English Renaissance, 1500-1600.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
316. **Tudor Drama Exclusive of Shakespeare.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
317. **Spenser.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
318. **Shakespeare, I.** Earlier tragedies, comedies, and history plays. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
319. **Shakespeare, II.** Mature tragedies, dark comedies, and late romances. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
321. **Poetry and Prose from the Metaphysicals to 1660.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
322. **English Drama, 1603-42.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
323. **Milton.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
326. **English Literature of the Restoration and Early Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
327. **English Literature of the Later Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
328. **English Drama of the Restoration and Eighteenth Century.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
329. **Restoration and Eighteenth-Century Fiction.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
331. **English Romantic Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
333. **Early Victorian Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
334. **Later Victorian Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
335. **Nineteenth-Century British Fiction.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
341. **British Literature in the Twentieth Century to 1930.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
342. **British Literature in the Twentieth Century Since 1930.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
343. **The Plays of Bernard Shaw.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
346. **American Literature of the Colonies and Early Republic.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
347. **Literature of the American Renaissance.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
350. **American Literature from the Civil War to the First World War.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
351. **American Literature from the First World War to the Present.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
355. **Major Authors.** Intensive study of the work of one or two major authors. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated as topic varies.
361. **Topics in English Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once as topic varies.

362. **Topics in American Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
363. **Special Topics in the Study of Literature.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once for credit.
364. **Tragedy.** History and theory of stage tragedy. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
365. **Comedy.** History and theory of stage comedy. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
366. **Topics in Modern Drama.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
367. **The International Folk Tale.** Same as Comparative Literature 359. Origin, nature, and distribution of the folk tale. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
368. **The Ballad and Folksong in the United States.** English-language traditional songs and ballads, transplanted and native. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
370. **Vladimir Nabokov.** Same as Russian 370 and Comparative Literature 370. The major contribution of Vladimir Nabokov to world literature. No knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
375. **Topics in the Relation of Other Disciplines to the Study of Literature.** See *Timetable* for current topics. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit. May be repeated once as topic varies.
381. **Theory and Practice of Written Composition.** History and theory of written composition; basic rhetorical principles; and guidance and criticism of student writing. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
382. **Literary Criticism from Plato to 1800.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
383. **Literary Criticism from 1800 to the Present.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
385. **Literature for the High School.** Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
387. **Introduction to Myth and Folklore.** Same as Comparative Literature, German, Slavic and Speech Communication 387. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
400. **Introduction to Research and Critical Techniques.** Introductory course in methods and techniques in research and literary criticism; strongly recommended for all students seeking the Ph.D. 1 unit.
403. **History of the English Language.** Study of the development of the language from the earliest stages to the present. Credit is not given for both English 403 and 303. 1 unit.
404. **Seminar in the English Language.** Prerequisite: Consent of instructor. 1 unit.
407. **Old English.** Introduction to the language before 1000 A.D. 1 unit.
408. **Beowulf.** Prerequisite: English 407 or consent of instructor. 1 unit.
409. **Old English Literature and Its Cultural Background.** Prerequisite: English 407 or consent of instructor. 1 unit. May be repeated as topic varies.
411. **Chaucer: *Troilus and Criseyde* and the Minor Poems.** 1 unit.
412. **Chaucer: *The Canterbury Tales*.** 1 unit.
413. **Middle English Literature and Its Cultural Background.** 1 unit. May be repeated as topic varies.
414. **Seminar in Medieval Literature.** Prerequisite: A college course devoted entirely to an aspect of medieval studies, or consent of instructor. 1 unit. May be repeated as topic varies.
419. **Seminar in Shakespeare.** Prerequisite: A college course devoted entirely to an aspect of Shakespeare's work, or consent of instructor. 1 unit. May be repeated as topic varies.
420. **Seminar in Sixteenth-Century Literature.** Prerequisite: A college course devoted en-

- tirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
424. **Seminar in Seventeenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of Renaissance studies, or consent of instructor. 1 unit. May be repeated as topic varies.
427. **Seminar in Restoration and Eighteenth-Century Literature.** Prerequisite: A college course devoted entirely to an aspect of eighteenth-century studies, or consent of instructor. 1 unit. May be repeated as topic varies.
433. **Seminar in Romantic Literature.** Same as Comparative Literature 452. Prerequisite: A college course devoted entirely to an aspect of Romantic studies, or consent of instructor. 1 unit. May be repeated as topic varies.
437. **Seminar in Victorian Literature.** Prerequisite: A college course devoted entirely to an aspect of Victorian studies, or consent of instructor. 1 unit. May be repeated as topic varies.
443. **Seminar in Modern British Literature.** Prerequisite: One college course devoted entirely to an aspect of modern British studies, or consent of instructor. 1 unit. May be repeated as topic varies.
447. **Seminar in Earlier American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
453. **Seminar in Later American Literature.** Prerequisite: One college course devoted entirely to an aspect of American studies, or consent of instructor. 1 unit. May be repeated as topic varies.
463. **Seminar in Literary Themes and Movements.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
464. **Seminar in Literary Modes and Genres.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
469. **Seminar in the Stage History of Classic English Plays.** Same as Speech Communication 469 and Theatre 405. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history, or consent of instructor. 1 unit.
478. **Seminar in the Relation of Other Disciplines to the Study of Literature.** Prerequisite: One year of graduate study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
481. **Seminar in Literary Theory and Criticism.** Prerequisite: A college course devoted entirely to criticism, or consent of instructor. 1 unit. May be repeated as topic varies.
487. **Seminar in the Teaching of English.** Prerequisite: One year of college study of literature, or consent of instructor. 1 unit. May be repeated as topic varies.
491. **Research in Special Topics.** Independent study under the guidance of a member of the graduate faculty. 1 unit. May be repeated for a total of 2 units.
493. **Professional Seminar in the Teaching of College English.** Prerequisite: Doctoral candidate standing or consent of instructor. 0 or 1 unit. May be repeated as topic varies but for 0 unit only. Students taking their first proseminar will be given priority in enrollment.
499. **Thesis Research.** Guidance in writing theses for doctoral degrees. Prerequisite: Doctoral candidate standing. 0 to 4 units.

RHETORIC AND COMPOSITION

103. **Writing Laboratory.** Intensive tutoring in basic writing skills to be scheduled at the Writing Laboratory. Prerequisite: Concurrent registration in Rhetoric 104 or 105, or Speech Communication 111 or 112, or written consent from the English Undergraduate Office. 1 hour. May be repeated for a total of 2 hours.

104. **EOP Rhetoric.** An introductory writing course designed for EOP students and with concentration on exposition; must be taken concurrently with Rhetoric 103, a 1-hour course offered at the Writing Laboratory. 3 hours.
105. **Principles of Composition.** Study of the methods of exposition, the problems of argument, the use of evidence, and style; practice in writing with primary emphasis on exposition. This course fulfills the campus rhetoric requirement. 4 hours.
108. **Forms of Composition.** Study of the methods of exposition, the problems of argument, the use of evidence, and style; examination of verbal and nonverbal composition through use of a thematic approach. See *Timetable* for current topics. This course fulfills the campus rhetoric requirement. 4 hours.
133. **Principles of Composition.** Practice in exposition, with emphasis on organization, paragraphing, and sentence structure. For the student whose career will require competence in writing clear, precise prose as an adjunct to other professional activity. Credit is not given for Rhetoric 133 and Rhetoric 143. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
143. **Intermediate Expository Writing.** Practice in expository types, with emphasis on style and critical analysis. Recommended for rhetoric majors. Credit is not given for Rhetoric 143 and Rhetoric 133. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
144. **Narrative Writing.** Practice in description, narrative sketches, and story writing. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
145. **Poetry Writing.** Practice in the writing of poetry; experimentation with a number of fixed forms and free verse, but emphasis mainly on the student's freedom to develop a personal style. Prerequisite: Fulfillment of campus rhetoric requirement, or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
202. **Communications Workshop.** Independent writing projects and examination of literature as the cultural basis of the student's specialized fields. 3 hours.
205. **Advanced Narrative Writing, I.** Practice in the writing of fiction, with emphasis on the short story. Prerequisite: Rhetoric 144 or equivalent. 3 hours.
227. **Advanced Expository Writing.** Types of nonfiction prose, including the essay, criticism, biography, and historical writing. Prerequisite: Rhetoric 133 or 143, or consent of instructor. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Speech Communication 263, Theatre 280, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.
302. **Advanced Writing Topics.** Practice in various literary genres and in their combinations for mature students who have some writing experience and a background of data and impressions which they wish to develop in writing of near-professional quality. Individual conferences at hours to be arranged. Prerequisite: Consent of instructor. 3 hours or 1 unit.
305. **Advanced Narrative Writing, II.** Continued practice in the writing of fiction, with emphasis on the longer story and novelette. Prerequisite: Rhetoric 205. 3 hours or 1 unit.
306. **The Writing of Poetry.** Practice of the writing of poetry aided by intensive study of examples. Prerequisite: Rhetoric 145. 3 to 6 hours, or 1 or 2 units. May be repeated for a maximum of 6 hours or 2 units.
355. **Creative Writing Tutorial.** Personal direction in a writing project: fiction (novel or short stories), drama, poetry, criticism, nonfiction, narrative, etc. Frequency of conference to be determined by the type of project. Prerequisite: A preparatory course in advanced writing (Rhetoric 205, 227, 305, or 306; or Speech Communication 263 or 363). 3 to 6 hours, or 1 to 2 units. May be repeated for a maximum of 6 hours or 2 units.

French

Acting Head of Department: Professor E. Talbot

Department Office: 2090 Foreign Languages Building, Urbana

101. **Elementary Course, I.** Grammar, pronunciation, reading of modern authors, composition, and conversation. For students who have had no work in French. All students are required to attend two twenty-minute laboratory sessions per week. 4 hours.
102. **Elementary Course, II.** Continuation of French 101. All students are required to attend two twenty-minute laboratory sessions per week. Prerequisite: French 101 or one year of high school French. 4 hours.
103. **Modern French.** Reading of modern authors; conversation and pronunciation; and syntax and some composition. Students planning to major or minor in French should take French 133 in lieu of French 103. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
104. **Modern French Literature and Civilization.** Continuation of French 103. Reading of modern authors and an introduction to French civilization; some syntax and composition; and conversational practice. Completion satisfies graduation requirements in the College of Liberal Arts and Sciences. Students planning to take advanced French courses are to take French 134 in lieu of French 104. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
105. **Intensive Elementary French.** Equivalent to French 101 and 102. Oral comprehension, speaking, reading, and writing skills approached by the audiolingual method; some reading of literary texts. For students who have had no previous French and who want to learn at a rapid rate. All students are required to register for two hours of work weekly in the language laboratory. 8 hours.
106. **Intensive Elementary and Intermediate French.** Combines French 102 and 103 for students having attained 101 proficiency and who wish to advance more rapidly. Prerequisite: French 101 or equivalent, or a placement score showing high school achievement equivalent to French 101. 8 hours.
107. **Intensive Intermediate French.** Combines French 103 and 104 for students having attained 102 proficiency and who wish to advance more rapidly. Prerequisite: French 102 or 105, or equivalent. 8 hours.
113. **Conversational Practice.** Oral practice for the development of elementary conversational skill and the improvement of pronunciation. Designed as a supplement to French 103 or 104, and open only to students concurrently enrolled in either French 103 or 104. Prerequisite: French 102 or two years of high school French. 1 hour.
114. **Conversational French.** Practice in spoken French. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or 123, or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
123. **Readings in French Literature.** Readings in French literature (texts in French with discussion in English); some grammar essential to development of reading skill; and additional readings in English of authors treated assigned according to demonstrated interest. Serves as prerequisite to French 124; students planning to take advanced French courses should enroll in French 133. Prerequisite: French 102 or equivalent, or a placement score showing high school achievement equivalent to French 102. 4 hours.
124. **Readings in French Literature.** Additional readings in English of authors treated will be assigned according to demonstrated interest. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite:

- French 103; French 123; placement by virtue of high school units (usually three years). 4 hours.
133. **Accelerated Modern French.** Same as French 103, but accelerated for those interested in pursuing French in advanced courses. Prerequisite: French 102 or two semesters of college French, or a placement score showing high school achievement equivalent to French 102. Normally for students with a B average in French or with consent of instructor. 4 hours.
134. **Accelerated Modern French Literature and Civilization.** Reading of major French writers from several centuries, and introduction to French civilization, syntax and composition, and conversational practice. An accelerated course for those intending to take advanced courses in French. Prerequisite: French 133, or French 103 with department approval, or three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
144. **France and the French in the Twentieth Century.** Contemporary French life and institutions reflected in modern writing; some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103, three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
154. **Contrastive Studies of French and American Culture.** Provocative commentaries on aspects of American life and institutions by contemporary French writers and intellectuals; some syntax, composition, and conversational practice. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite for advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or three semesters of college French, or a placement score showing high school achievement equivalent to French 103. 4 hours.
164. **French Readings in the General Sciences.** Designed for those interested in a reading background in general scientific works. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences; does not serve as a prerequisite to advanced courses in French without departmental approval which usually requires a proficiency examination at the 104 level. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
174. **Readings in French Newspapers and Magazines.** Study of current events and contemporary French life from the reading of newspapers and magazines specially ordered from France; requires fee of \$5.00 to cover subscription cost. May be substituted for French 104 to satisfy graduation requirements of the College of Liberal Arts and Sciences; does not serve as a prerequisite to advanced courses in French without departmental approval which usually requires examination at the 104 level. Prerequisite: French 103 or equivalent, or a placement score showing high school achievement equivalent to French 103. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Introduction to French Literature.** Prerequisite: French 104 or 107, or four years of high school French, or equivalent. 3 hours.
202. **Introduction to French Literature.** Continuation of French 201. Prerequisite: French 104 or 107, or four years of high school French, or equivalent. 3 hours.
211. **Oral French, I.** Training for the development of oral facility; exercises for the improvement of pronunciation and diction; and optional practice in the language laboratory. Prerequisite: French 104 or 107, or 103 and 113, or four years of high school French. 3 hours.
212. **Oral French, II.** Continuation of French 211; optional practice in the language laboratory. Prerequisite: French 211. 3 hours.

215. **Grammar and Composition.** Training in French syntax, translation from English into written French, and directed composition. Prerequisite: Four years of high school French or equivalent, or French 134 or, with departmental approval, French 104 or 107. 3 hours.
217. **Advanced Oral French.** An intensive course stressing comprehension, pronunciation, diction, and fluency; work includes conversation, oral reports, and group discussions. Required of French teacher-education majors. Prerequisite: French 212. 4 hours.
218. **Conversation dirigée.** Directed conversation stressing fluency and accuracy in French through conversations, reports, and discussions specifically centered around contemporary French life and culture. May not be used to satisfy major requirements. Prerequisite: French 217 or equivalent. 2 hours.
220. **Sixteenth-Century Literature.** General survey of the literature of the French Renaissance. Prerequisite: French 201 and 202. 3 hours.
223. **French Literature of the Seventeenth Century, I.** Major French writers of the preclassical period. Prerequisite: French 201 and 202. 3 hours.
224. **French Literature of the Seventeenth Century, II.** Major French writers of the classical period. Prerequisite: French 201 and 202. 3 hours.
227. **French Literature of the Eighteenth Century, I.** Montesquieu, Voltaire, and their contemporaries. Prerequisite: French 201 and 202. 3 hours.
228. **French Literature of the Eighteenth Century, II.** Diderot, Rousseau, and their contemporaries. Prerequisite: French 201 and 202. 3 hours.
230. **French Literature of the Nineteenth Century, I: 1800-1850.** Major prerealist and romantic writers. Prerequisite: French 202 or equivalent, or consent of instructor. 3 hours.
231. **French Literature of the Nineteenth Century, II: 1850-1900.** The evolution of romanticism and realism into the naturalist and symbolist movements. Prerequisite: French 202 or equivalent, or consent of instructor. 3 hours.
233. **French Literature of the Contemporary Period, I.** Modern poetry from Baudelaire to Valéry; prose writers from 1900 to 1940. Prerequisite: French 201 and 202. 3 hours.
234. **French Literature of the Contemporary Period, II.** Continuation of French 233. Prerequisite: French 201 and 202. 3 hours.
255. **Introduction to French Literature in Translation, I.** Study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures in English; not open to students majoring in French. 4 hours.
256. **Introduction to French Literature in Translation, II.** Study of selected major works of French literature from the romantic period to the present. Texts and lectures in English; not open to students majoring in French. 4 hours.
270. **Parateaching in French.** Parateaching prior to the practicum in local schools under the direct supervision of University of Illinois French faculty and the teaching staff of participating public schools. Prerequisite: French 212 and 215, or equivalent; permission of French teaching education adviser. 2 hours. May be repeated for credit.
280. **Teachers Course.** Survey of resources, classroom materials, standard practices, and problems in the teaching of French with practical application to actual classroom situations. Required for teacher training majors in French. This course does not meet during the period teacher-training majors are off campus. Prerequisite: French 201 and 202, and 211 and 212, and 215, or equivalent. 4 hours.
288. **French and Comparative Cinema, I.** Selected world cinema trends to approximately 1960, with emphasis on French directors (Clair, Vigo, Renoir, Carne, Clouzot, etc.); aesthetic, sociopolitical, historical, literary, and technical aspects; meets six hours a week. No knowledge of French necessary. Prerequisite: One University-level film studies course or consent of instructor. 4 hours.
289. **French and Comparative Cinema, II.** Continuation of French 288. Selected world cinema trends since approximately 1960, with emphasis on French directors (Chabrol, Godard, Truffaut, Resnais, Marker, Rohmer, etc.); meets six hours a week. No knowl-

edge of French necessary. Prerequisite: One University-level film studies course or consent of instructor. 4 hours.

290. **Individual Study: Major Tutorial.** A tutorial taken by students in the course of two of their last four semesters of undergraduate study. Students read the works on a departmental reading list with the guidance of a tutor, repeating enrollment for a total of 2 hours credit, normally at the rate of 1 hour per semester. Prerequisite: French 201, 202, 211, and 215, or equivalent; a declared field of concentration in French; junior standing. 1 to 2 hours.
292. **Senior Thesis.** For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours. May be repeated for a maximum of 4 hours credit.
298. **Senior Seminar.** Studies in authors, genres, themes, and movements in French literature; conducted entirely in French. Prerequisite: Senior standing. 3 hours. May be repeated for credit.
299. **Study Abroad.** Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 201 and two of the following: French 211, 212, or 215; 3.75 overall average; 4.0 average in French courses. 0 to 16 hours per semester, to a total of 32 hours.
311. **Diction.** Training in the improvement of French pronunciation, with special attention to the problems of teachers. It is recommended that French 311 and 313 be taken concurrently. Prerequisite: French 211 or equivalent. 2 hours or $\frac{1}{2}$ unit.
313. **Phonetics.** Systematic study of the sounds and sound patterns of French. It is recommended that French 313 and 311 be taken concurrently. Prerequisite: French 212 or equivalent. 3 hours or $\frac{3}{4}$ unit.
314. **Advanced Grammar and Style.** Advanced theoretical and practical study of present-day French, with free composition and some consideration of stylistics. Prerequisite: French 215 or equivalent. 3 hours or $\frac{3}{4}$ unit.
315. **Style and Translation.** Linguistic analysis of a variety of French prose styles to illustrate the range of expressions for the same or similar ideas; translation into French of fairly difficult English prose. Prerequisite: French 314. 3 hours or $\frac{3}{4}$ unit.
316. **Structure of the French Language.** Same as Linguistics 316. General survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax; emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or $\frac{3}{4}$ unit.
321. **Studies in French Literature in Translation.** Major writers or themes of French literature studied in English translation; see *Timetable* for current topics. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated to a maximum of 6 hours or 2 units. Credit not applicable to degree programs in French.
335. **French Civilization, I.** Survey of French life and French institutions, intended as a background for literary studies and as a preparation for the teaching of French; given in French. Prerequisite: French 201, 202, 211, and 215, or equivalent. 3 hours or $\frac{3}{4}$ unit.
336. **French Civilization, II.** Continuation of French 335. Prerequisite: French 201, 202, 211, and 215, or equivalent. 3 hours or $\frac{3}{4}$ unit.
343. **Studies in French Literature.** See *Timetable* for current topics. Prerequisite: Junior standing. 3 hours, or $\frac{3}{4}$ to 1 unit.
355. **France Today, I.** Social structures of France today and their manifestation in daily life and culture; study of the workings of various institutions and systems (political, judicial, economic, educational, etc.) for an understanding of current problems, providing background for closer study, in the second semester, of the forces affecting daily life. 3 hours, or $\frac{3}{4}$ to 1 unit.
356. **France Today, II.** Study of the conditions of daily life in France today, its organization, the major forces and issues affecting it; topics include class structure, youth culture, urban and minority problems, the press, media, and popular culture and the arts. 3 hours, or $\frac{3}{4}$ to 1 unit.

362. **Introduction to Romance Linguistics.** Same as Italian, Linguistics, Portuguese, Romance Linguistics, and Spanish 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
379. **Studies in Francophonie.** Studies of various genres, periods, and topics of French literature outside of France, with a different geographical emphasis each semester. Regions include black Africa, the Caribbean, Canada, North Africa, the Middle East, and Switzerland. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated to a maximum of 12 hours or 4 units.
382. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, German, Humanities, Slavic, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
399. **Study Abroad.** Lectures, seminars, and practical work in francophone literature and civilization, in a French-speaking country. Prerequisite: French 201 and 202, and two of the following: French 211, 212, and 215; or equivalent. Not open to undergraduates in the Paris program. 0 to 16 hours, or 0 to 4 units.
400. **Beginning French for Graduate Students.** Basic grammar, vocabulary, and reading practice; designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. 4 hours. No graduate credit.
401. **Reading French for Graduate Students.** Grammar, vocabulary, and general and special reading; designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. Prerequisite: French 400, or French 101 and 102, or equivalent. 4 hours. No graduate credit.
403. **The Study of Culture: Fine Arts, History, and Literature, I.** Master works studied with a special view to their presentation in foreign language programs in secondary schools and in junior colleges; designed for students in the program for the Master of Arts in the Teaching of French. 1 unit.
404. **The Study of Culture: Fine Arts, History, and Literature, II.** Continuation of French 403. Prerequisite: French 403 or consent of instructor. 1 unit.
405. **Techniques in Teaching College and Secondary French.** Examination and discussion of classroom procedures and language laboratory techniques in teaching French at the college and secondary level, associated with demonstration class and supervision of teaching practice. Required of new teaching assistants in the Department of French. 0 credit.
427. **History of the French Language.** A study of the development of the French language from Vulgar Latin to the present day. 1 unit.
430. **Introduction to Research and Textual Criticism.** Proseminar in literary studies: research and methods; approaches to the literary text. Required of all M.A. and Ph.D. candidates. 1 unit.
431. **Introduction to Old French Language.** Outline of Old French grammar and training in reading Old French (twelfth and thirteenth centuries). 1 unit.
432. **Studies in Medieval French Literature.** Close study of one or more topics in Old French literature. See *Timetable* for current topics. Prerequisite: French 431 or consent of instructor. 1 unit.
433. **Studies in Sixteenth-Century French Literature, I.** Major writers of the sixteenth century studied with reference to the most important intellectual and religious preoccupations of their century. 1 unit.
434. **Studies in Sixteenth-Century French Literature, II.** Themes and techniques of major poets and poetic schools of the sixteenth century. 1 unit.
435. **Studies in Seventeenth-Century French Literature, I.** 1 unit.
436. **Studies in Seventeenth-Century French Literature, II.** 1 unit.

437. **Studies in Eighteenth-Century French Literature, I.** 1 unit.
438. **Studies in Eighteenth-Century French Literature, II.** 1 unit.
439. **Studies in Nineteenth-Century French Literature.** Close study of one or more topics in nineteenth-century French literature; see *Timetable* for current topics. 1 unit. May be repeated to a maximum of 2 units.
441. **Studies in Twentieth-Century French Literature, I.** 1 unit.
442. **Studies in Twentieth-Century French Literature, II.** 1 unit.
443. **French Studies.** A flexible course limited only by the concentration of its material in French; may be activated by student request or faculty proposal. 1 unit.
447. **Introduction to Romance Stylistics.** Same as Italian, Portuguese and Spanish 447. A brief history of the schools and theories of Romance stylistics, especially the French-Swiss *stylistique* (Bally, Marouzeau, and Cressot) and the German-Spanish *Stilforschungen* (Spitzer, Hatzfeld, Kayser, A. Alonso, and D. Alonso); includes a study of representative works and assigned topics for analysis. Prerequisite: Graduate standing in one of the Romance languages; reading knowledge of French and Spanish or consent of instructor. 1 unit.
448. **Studies in French Descriptive Linguistics.** Selected specialized topics in the morphology, derivation, and syntax of contemporary standard French; topics vary each semester, e.g., verb morphology, noun derivation, interrogative systems, and nominal phrases. Prerequisite: French 316. 1 unit.
452. **Studies in French and Comparative Cinema.** Same as Comparative Literature 472. Historical, aesthetic, social, and technical studies of the French cinema; its development and relation to world cinema and to literature. 1 unit. May be repeated to a maximum of 3 units credit.
462. **Seminar in Romance Linguistics.** Same as Italian, Linguistics, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: French 362 and consent of instructor. 1 unit.
463. **College Teaching of Foreign Languages.** Same as English as a Second Language, German, Russian, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
468. **Old Provençal Literature.** Selected readings of various genres, emphasizing lyric poetry and with attention to its position in European literature; lectures in English. Prerequisite: Consent of instructor. 1 unit.
470. **Seminar in Old French Literature.** Discussion and research on some specialized topic in Old French literature. See *Timetable* for current topic. Prerequisite: French 431 or consent of instructor. 1 unit. May be repeated for credit.
471. **Seminar in Sixteenth-Century French Literature.** Discussion and research on some specialized topic in sixteenth-century French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.
472. **Seminar in Seventeenth-Century French Literature.** Discussion and research on some specialized topic in seventeenth-century French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.
473. **Seminar in Eighteenth-Century French Literature.** Discussion and research on some specialized topic in eighteenth-century French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.
474. **Seminar in Nineteenth-Century French Literature.** Discussion and research on some specialized topic in nineteenth-century French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.
478. **Seminar in Twentieth-Century French Literature.** Same as Comparative Literature 478. Discussion and research on some specialized topic in twentieth-century French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.
479. **Seminar in French Literature.** Discussion and research on some specialized area in French literature. See *Timetable* for current topic. 1 unit. May be repeated for credit.

- 481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as English as a Second Language, German, Russian, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Consent of instructor. 1 unit.
- 482. **Seminar in French and Comparative Cinema.** Same as Comparative Literature 473. Study of major French directors within the context of French and international cinema; their comparison with selected non-French directors; and the relationships of films and other literary forms. 1 unit.
- 491. **Individual Topics.** Prerequisite: Graduate standing with a major or minor in French. $\frac{1}{4}$ to 1 unit.
- 499. **Thesis Research.** 0 to 4 units.

Germanic Languages and Literatures

(Including German, Germanic, and Scandinavian)

Head of Department: Professor E. H. Antonsen

Department Office: 3072 Foreign Languages Building, Urbana

GERMAN

- 101. **Elementary Course.** Oral practice, reading, and grammar for beginners. 4 hours.
- 102. **Elementary Course.** Continuation of German 101. Prerequisite: One semester of college German or equivalent. 4 hours.
- 103. **Intermediate Course.** Continuation of German 102. Prerequisite: Two semesters of college German or equivalent. 4 hours.
- 104. **Intermediate Course.** Continuation of German 103. Prerequisite: Three semesters of college German or equivalent. 4 hours.
- 112. **Elementary Speaking.** Practice in speaking idiomatic German; emphasis on spontaneous expression. Prerequisite: One semester of college German or equivalent. 4 hours.
- 113. **Intermediate Speaking.** Continuation of German 112. Prerequisite: Two semesters of college German or equivalent. 4 hours.
- 114. **Intermediate Speaking.** Continuation of German 113. Prerequisite: Three semesters of college German or equivalent. 4 hours.
- 122. **Elementary Reading.** Practice in reading German, with emphasis on expository prose. Prerequisite: One semester of college German or equivalent. 4 hours.
- 123. **Intermediate Reading.** Continuation of German 122. Prerequisite: Two semesters of college German or equivalent. 4 hours.
- 124. **Intermediate Reading.** Continuation of German 123. Prerequisite: Three semesters of college German or equivalent. 4 hours.
- 153. **Practice in Conversation.** Emphasis on learning to converse in German in an everyday manner. Prerequisite: Two semesters of college German or equivalent. 2 hours.
- 189. **Living German--German Living.** Practice in speaking German for students living in the German House. Prerequisite: Elementary speaking knowledge of German. 1 hour. May be repeated to a maximum of 3 hours.
- 199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
- 201. **German Literature Since 1648 in English Translation.** Important trends in German literature since 1648; reading of some important prose works. For students with no knowledge of German. 3 hours.
- 202. **Society in the Novel.** No knowledge of German required. Portrayal of society in German novels from 1648 to the present; reading and discussion of works by Grimmelshausen, Goethe, Hoffmann, Fontane, Thomas Mann, Hesse, Kafka, and Grass. 3 hours.

203. **Goethe in Translation.** Same as Comparative Literature 203. Introduction to the life and works of Johann Wolfgang von Goethe; focus on his poetic work and treatment of his major contributions to science as imaginative literature. 3 hours.
204. **Medieval Literature in Translation.** Same as Comparative Literature 204. German medieval precourtly and courtly literature in the European context; readings in the works of Hartmann von Aue, Gottfried von Strassburg, Wolfram von Eschenbach, and others, including the following epics: *Nibelungenlied*, *Gregorius*, *Tristan*, and *Parzival*. 3 hours.
208. **German Source Readings from the History of Science.** Reading and discussion of eighteenth- and nineteenth-century contributions to physics, chemistry, and biology which are basic in the respective disciplines. Prerequisite: German 104 or 124, or consent of instructor. 3 hours.
210. **Masterpieces of German Literature.** Introduction to German literature, its subjects, forms, movements, and ideas. Prerequisite: Two years of college German or equivalent. 3 hours.
211. **Conversation and Writing.** Prerequisite: German 104 or equivalent, or consent of instructor. 3 hours.
212. **Conversation and Writing.** Continuation of German 211. Prerequisite: German 211 or equivalent, or consent of instructor. 3 hours.
250. **The German Novelle of the Nineteenth Century.** Selected works of representative writers (such as Brentano, Droste-Hulshoff, Hoffmann, Hauptmann, Kleist, Meyer, Stifter, Storm). Prerequisite: German 210 or equivalent. 3 hours.
251. **The German Novelle of the Twentieth Century.** Selected works of representative writers (such as Brecht, Boll, Grass, Hesse, Kafka, Mann). Prerequisite: German 210 or equivalent. 3 hours.
252. **Nineteenth-Century German Drama.** Selected works of representative playwrights (such as Buchner, Grillparzer, Hebbel, Kleist), including their eighteenth-century roots and their background in classical drama. Prerequisite: German 210 or equivalent. 3 hours.
253. **Twentieth-Century German Drama.** Modern German drama from Hauptmann to the present (such as Brecht, Borchert, Durrenmatt, Frisch, Kaiser, Weiss). Prerequisite: German 210 or equivalent. 3 hours.
260. **Lyrics and Ballads.** Poetical and metrical survey of German lyric verse from its beginnings to modern times, with a critical analysis of representative poems. Prerequisite: German 210 or equivalent. 3 hours.
270. **Twentieth-Century German Literature.** Introduction to trends of modern civilization as reflected in contemporary German literature. Prerequisite: German 210 or equivalent. 3 hours.
280. **Teachers' Course.** Introduction into the problems of the teaching of German and a study of textbooks. Prerequisite: Senior standing or consent of instructor. 4 hours.
293. **Honors Senior Thesis.** Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 to 4 hours. May be repeated.
296. **Special Topics in German Literature.** Introductory study in such topics as individual authors, selected literary movements or periods, modes of inquiry in literary study, minor genres, subgenres, extraliterary influences, etc. Prerequisite: Reading fluency in German beyond the fourth-semester college level. 3 hours.
299. **Study Abroad.** Lectures, seminars, and practical work in language, literature, education, and civilization, in Austria. Prerequisite: German 211 or equivalent; 3.75 overall average; 4.0 in German courses. 0 to 16 hours per semester to a maximum of 32 hours, all of which must be earned in two semesters.
300. **German Literature 750-1450.** Literary, thematic, cultural, and bibliographical analysis of the major authors, works, genres, and movements in German literature from 750 to 1450. Prerequisite: German 210 and one other course in German literature or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

301. **German Literature 1450-1700.** A literary, thematic, cultural, and bibliographical analysis of the major authors, works, genres, and movements in German literature from 1450 to 1700. Prerequisite: German 210 and one other 300-level course in German literature, or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **German Literature Since 1700.** Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
303. **Advanced Conversation, Composition, and Syntax.** Intensive study of advanced problems of grammar, syntax, and style. Prerequisite: German 211 and 212, or equivalent. 3 hours or $\frac{1}{2}$ unit.
304. **Advanced Conversation.** Practice in free conversation with native speaker. Prerequisite: German 303 or equivalent. 1 hour or 0 unit.
305. **Modern German Poetry.** A poetical and metrical survey of modern German lyric verse. Prerequisite: German 210 and one other course in German literature, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
306. **Contemporary German Poetry.** Poetical and metrical survey of contemporary German lyric verse. Prerequisite: German 305 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
311. **Goethe.** Introduction to Goethe's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
312. **Goethe's Faust.** Intensive study of Goethe's *Faust*, parts I and II, with an examination of the theme's evolution in literature. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
320. **History of German Civilization.** Selected topical, historical, and pictorial analysis of Germany's culture and civilization. Prerequisite: German 210 and one other course in German literature, or equivalent. 4 hours or $\frac{3}{4}$ unit.
330. **Martin Luther.** Same as Religious Studies 330. Special attention to Luther as an artist, and to his importance for the development of German language and literature; attention also paid to the historical and intellectual trends of the fifteenth and sixteenth centuries as well as to the significance of Luther in modern psychological and sociological thought. Prerequisite: A reading knowledge of German. 3 hours or $\frac{3}{4}$ unit.
331. **The Age of Lessing.** The life and works of Gotthold Ephraim Lessing and his contemporaries. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
332. **Schiller.** Introduction to Friedrich Schiller's life and works; reading and discussion of selected dramas, ballads, philosophical poems, and major essays. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.
365. **German Phonology and Morphology.** Introductory survey of the phonological and morphological structure of the German language. Prerequisite: Three years of college German or equivalent. 3 hours or $\frac{3}{4}$ unit.
382. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, French, Humanities, Slavic, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
387. **Introduction to Myth and Folklore.** Same as Comparative Literature, English, Slavic, and Speech Communication 387. Prerequisite: One year of college literature or consent of instructor. 3 hours or 1 unit.
390. **The German Cinema.** History and criticism of the German film from its beginnings through Expressionism and the New Objectivity of the 1920s, the Third Reich and the period of decline, to the young German film of the 1960s; weekly film screenings, lectures, and discussions. Knowledge of German useful but not required. 3 hours or $\frac{3}{4}$ unit.
396. **Special Topics in German Literature.** Intensive study of individual authors or other restricted topics in German literature. Prerequisite: Two advanced courses in German literature. 4 hours, or $\frac{3}{4}$ or 1 unit.

400. **Beginning German for Graduate Students.** Introduction to the reading of German texts in the sciences and the humanities. 4 semester hours. No graduate credit.
401. **Readings in German for Graduate Students.** Designed for graduate students preparing for the German reading requirements for the Ph.D. Prerequisite: German 400 or equivalent. 4 semester hours. No graduate credit.
411. **Proseminar.** Methods of literary criticism and research. To be taken concurrently with German 495. 1 unit.
412. **Proseminar.** Methods in German language study. Prerequisite: German 365 or equivalent. 1 unit.
415. **Middle High German.** Prerequisite: German 365. 1 unit.
416. **Middle High German Literature.** Prerequisite: German 415 or equivalent. 1 unit.
420. **History of the German Language.** The internal and external history of German from prehistoric times to the present. Prerequisite: German 365 or equivalent. 1 unit.
441. **German Romanticism.** 1 unit.
442. **Nineteenth-Century German Realism.** German realism as manifested in the literature between romanticism and naturalism, with emphasis on so-called poetic realism. Prerequisite: German 301 and 302, or equivalent. 1 unit.
445. **Old High German.** Grammar and interpretation of the oldest literary documents. Prerequisite: German 365. 1 unit.
447. **Old Saxon.** Synchronic-diachronic treatment of the language of the *Heliand* and *Genesis*; the position of Old Saxon in the Germanic languages with particular reference to Old High German and Old English. Prerequisite: German 445 or English 401, or consent of instructor. 1 unit.
451. **Naturalism, Symbolism, and Expressionism.** Same as Comparative Literature 441. Comparative analysis of German literature from the 1880s to the 1920s within the European context. 1 unit.
452. **German Literature from the Twenties to the Present.** Trends, problems, and personalities in recent German literature, including exile literature and literature of the Third Reich. Prerequisite: German 301 and 302, or equivalent. 1 unit.
460. **Seminar in Older German Literature.** Topics range from the earliest known literature to the Enlightenment. Prerequisite: German 411 and 495. 1 unit. May be repeated as topics vary.
461. **Seminar in Modern German Literature.** Same as Comparative Literature 482. Topics range from the Enlightenment to the present. Prerequisite: German 411 and 495. 1 unit. May be repeated as topics vary.
462. **Seminar in Literary Genres and Forms.** Same as Comparative Literature 461. Study of a form (the lyric, the novel, the drama, etc.) to discover its essential components in all the literatures studied and the significance of national variations. 1 unit. May be repeated to a maximum of 3 units as topic varies.
463. **College Teaching of Foreign Languages.** Same as French, Russian, Spanish, and English as a Second Language 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
480. **Teaching German in College.** Introduction to the problems of teaching German in college. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as French, Russian, Spanish, and English as a Second Language 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Consent of instructor. 1 unit.
493. **Research in Special Topics.** $\frac{1}{4}$ to 2 units. May be repeated for a maximum of 2 units.
495. **Bibliography and Methods in Literary Research.** To be taken concurrently with German 411. $\frac{1}{2}$ unit.

499. **Thesis Research.** 0 to 4 units (summer session, 0 to 2 ½ units).

GERMANIC

367. **Introduction to Germanic Linguistics.** Same as Linguistics 367. Comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent; some knowledge of German desirable. 2 hours or ½ unit.
426. **Gothic.** Synchronic and diachronic study of the Gothic language and its relationship to other Germanic and Indo-European languages; extensive reading of extant texts. Prerequisite: Germanic 367 or consent of instructor. 1 unit.
462. **Seminar in Germanic Linguistics.** Varying topics dealing with problems in diachronic and synchronic Germanic linguistics. Prerequisite: Consent of instructor. 1 or 2 units. May be repeated as topics vary.
465. **Comparative Germanic Phonology and Morphology.** Reconstruction of the phonological and morphological systems of Proto-Germanic and their development into the Germanic languages and dialects. Prerequisite: Germanic 426 or consent of instructor. 1 unit.
467. **Runology.** Detailed analysis of inscriptions in the "older" Germanic futhark, the Anglo-Frisian futhorc, and the Scandinavian "younger" futharks; their relationships and the correlation between phonological and orthographic developments. Prerequisite: Germanic 465 or consent of instructor. 1 unit.

SCANDINAVIAN

101. **Elementary Scandinavian, I.** The first of four semesters leading to a reading knowledge of Danish, Norwegian, and Swedish, and to an oral command of one of these languages; linguistic structure, reading, and oral practice. 4 hours.
102. **Elementary Scandinavian, II.** Continuation of Scandinavian 101. Structural differences between Danish or Swedish and Norwegian; oral practice and reading of simple texts. Prerequisite: Scandinavian 101. 4 hours.
103. **Intermediate Scandinavian, I.** Readings in Danish and Norwegian (or Swedish) literature; structure of Swedish (or Danish and Norwegian), with stress on the differences between Swedish and Danish. Prerequisite: Scandinavian 102 or equivalent. 4 hours.
104. **Intermediate Scandinavian, II.** Continuation of Scandinavian 103. Readings in classical and modern Danish, Norwegian, and Swedish texts. Prerequisite: Scandinavian 103. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
216. **Conversation and Writing.** Oral practice and composition in one of the Scandinavian languages. Prerequisite: Scandinavian 104. 2 hours.
293. **Honors Senior Thesis.** Prerequisite: Senior standing; consent of instructor. 1 to 2 hours.
361. **Ibsen in Translation.** Dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit.
362. **Strindberg and the Later Scandinavian Dramatists in Translation.** Major dramas and prose works of August Strindberg; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Par Lagerkvist. 3 hours or 1 unit.
405. **Old Norse-Icelandic, I.** Grammar and selected readings. 1 unit. Offered in alternate years.
406. **Old Norse-Icelandic, II.** Readings; selections from the Elder Edda and the sagas. Prerequisite: Scandinavian 405. 1 unit. Offered in alternate years.

History

Chairperson of Department: Professor W. L. Arnstein

Department Office: 309 Gregory Hall

111. **History of Western Civilization to 1815.** Europe from the age of the great discoveries to the close of the Napoleonic Wars. 4 hours.
112. **History of Western Civilization, 1815 to the Present.** Development of European nationalism, liberalism, and imperialism; world wars; and reconstruction. 4 hours.
131. **History of England to 1688.** Survey of the political and constitutional, social and economic, church and cultural, and imperial history of the British people from the beginning of English history through the revolution of 1688. 4 hours.
132. **History of England, 1688 to the Present.** Survey of the political and constitutional, social and economic, diplomatic and imperial, and cultural history of the British people from 1688 to the present. 4 hours.
151. **History of the United States to 1877.** Colonial foundations, movement for independence, and early years of the republic. Students are not given credit for both History 151, and History 260 and 261. 4 hours.
152. **History of the United States, 1877 to the Present.** A century of national life and organization. Students are not given credit for both History 152 and 262. 4 hours.
161. **Man and Society in East Asia, I.** Same as Asian Studies 161. A topical approach to the major themes of Chinese and Japanese civilizations through an examination of how people in these civilizations approached basic human and social problems. 3 hours.
162. **Man and Society in East Asia, II.** Same as Asian Studies 162. Continuation of Asian Studies/History 161. Prerequisite: Asian Studies/History 161. 3 hours.
168. **Indian Civilization and Society.** Same as Anthropology 168. Introductory survey course on an interdisciplinary basis dealing with the evolution of Indian religion, politics, culture, and social organization. 4 hours.
169. **South Asia in the Modern Period.** Same as Anthropology 169. Interdisciplinary introduction to modern South Asian history and society. 4 hours.
171. **History of East Asia, I.** Survey of the development of Chinese and Japanese history, civilization, and institutions prior to the seventeenth century. 4 hours.
172. **History of East Asia, II.** Survey of China and Japan in modern times with particular reference to the modernization and revolutionary processes in East Asia. Prerequisite: History 171. 4 hours.
173. **Islamic History and Civilization in the Near and Middle East to 1770.** Development of Islamic beliefs, institutions, and culture in the nuclear Islamic region (the present area of the Arab countries and Israel, Iran, and Turkey) from Mohammed to the age of European expansion. 4 hours.
174. **Islamic History and Civilization in the Near and Middle East Since 1700.** Islamic civilization since the age of European expansion; imperialism, Westernization, nationalism, and modernization. Arab countries, Israel, Iran, and Turkey are covered. 4 hours.
175. **Latin America from Conquest to Independence.** Survey of Latin American history from the discovery of America to 1824. 3 hours. Credit may not be received for both History 175 and 275.
176. **Modern and Contemporary Latin America.** History of the Latin American republics from their independence to the present; emphasis on Argentina, Brazil, Chile, Colombia, Cuba, and Mexico. 3 hours. Credit may not be received for both History 176 and 275.
181. **The Ancient World.** Ancient empires and Greece. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
182. **The Ancient World.** Rome. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours.
198. **Freshman Seminar.** Through research, reports, and discussion in a selected field of historical study, the seminar provides an in-depth understanding of the problems of that

field and of the methodology of history as a discipline. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 to 4 hours. May be repeated to a total of 6 hours.

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
203. **The Age of Localism: The Early Middle Ages.** The failure of imperial Rome and the rise of the Church; the organization of European society on a local basis through manorialism and feudalism. 3 hours.
204. **The Revival of Europe: The High and Later Middle Ages.** The revival of the economy; the expansion of Europe; and the rise of national states. 3 hours.
211. **The Contemporary World: Political, Ideological, and International Forces.** Interpretation of the contemporary world covering the legacy of imperialism, militarism, and world politics, the revolt of the masses, the totalitarian state, nationalism, internationalism, and such related topics. 3 hours.
212. **The Contemporary World: Economic, Social, and Cultural Aspects.** Interpretation of the contemporary world covering the economics of global power, ideological and social forces, the individual and the modern mind, the collective society, the personality in history, and such related topics. 3 hours.
215. **History of North and West Africa.** Survey of major themes and events in the history of North and West Africa from prehistoric times and the peopling of Africa through the advent of Islam; North and West African empires and states in the medieval period; the arrival and departure of European colonial powers; and the re-emergence of independent African states. 3 hours.
216. **History of East and Southern Africa.** Survey of major themes and events from the Bantu migrations and the rise of Aksum through the development of states and empires, Islam, the expansion of trade, European colonial rule, nationalism, and the persistence of white domination in the south. 3 hours.
219. **Survey of Russian History from Early Times to the Present.** Main themes and problems of Russian history from earliest times to the present. 3 hours.
247. **Science in Western Civilization, I.** The intellectual and social history of science from antiquity through the Enlightenment; special emphasis on the scientific revolution of the seventeenth century. 3 hours.
248. **Science in Western Civilization, II.** Topics in the intellectual and social history of modern science, 1789 to the present. 3 hours.
249. **History of Medicine.** Rise and development of medicine in the West since the sixteenth century; interrelations of physiology, pathology, and social demands with the theory and practice of medicine; patterns of professionalization; social role of the physician; conflict among ideas of medicine as an art, a science, and a social service; and problems of mental illness, medical ethics, and nontraditional forms of practice. Prerequisite: One year of college biology or chemistry, one year of college history, or consent of instructor. 3 hours.
253. **Afro-American History to 1877.** History of Africans in the Americas, surveying the African slave trade, slavery in the European colonies of the Americas, early United States slavery, and the Afro-American in the Civil War and Reconstruction. 3 hours.
254. **Afro-American History Since 1877.** History of Afro-Americans in the age of white supremacy; the rise of modern protest organizations; the era of integration; and the black power movement. 3 hours.
260. **Colonial Beginnings and Early United States History to 1815.** Social, economic, and political survey of the region and its relation to the evolving Atlantic community. Credit is not given for both History 260 and 151. 3 hours.
261. **The United States in the Nineteenth Century.** History of the United States from 1815 to 1900. Credit is not given for both History 261 and 151. 3 hours.
262. **The United States in the Twentieth Century.** One major emphasis on foreign policy, including the emergence of the United States as a great power after 1898; a second emphasis on the Progressive movement and recurrent attempts at the reform of American

society; and racial and urban problems and the conservation of natural resources included. Credit is not given for both History 262 and 152. 3 hours.

264. **Social History of Rural America.** Rural life in America from colonial settlement to the present, focusing on the nineteenth century; considers social, political, and economic aspects of rural society, emphasizing social themes such as the family community and responses to industrialization. 3 hours.
271. **French Colonization of North America, 1500-1778.** French, Indian, British, and Americans in Canada and the Trans-Appalachian West from the sixteenth century to the eighteenth century. Prerequisite: One year of college history. 3 hours.
272. **History of European Women.** Status of women in Europe, cross-culturally and by class, from ancient to modern times; exploration of the contributions of women as individuals and as groups to the distinctive development of Europe's national cultures. Prerequisite: One year of European history or consent of instructor. 3 hours.
274. **U. S. and World Crisis, 1917 to Present.** History of American foreign relations since World War I. 3 hours.
275. **Themes and Issues in Latin American History.** A thematic survey of major Latin American issues, trends, and events from the colonial period through the modern era. 3 hours. Credit may not be received for both History 275 and 175 or 176.
281. **History of Land Warfare.** A chronological survey of the history of war in the western world from ancient Greece to the present; designed to give a broad understanding of the interactions of military organizations and society in both war and peace. 3 hours.
282. **History of Naval Warfare.** A study of the development of naval warfare in the western world from ancient times to the present, with emphasis on naval developments and operations in the nineteenth and twentieth centuries. 3 hours.
290. **Individual Study.** Readings in selected fields in consultation with the instructor. Prerequisite: Junior or senior of high standing; written consent of the honors adviser. 2 to 4 hours.
293. **Honors Senior Thesis.** Two-semester research project. Prerequisite: History concentrator with senior standing and 4.25 average in history courses; written consent of honors adviser. May be taken by honors students in partial fulfillment of department honors requirements. 3 hours. Must be repeated for a total of 6 hours.
294. **Teaching of History.** Prerequisite: One year of college history; senior standing. 2 hours.
296. **Special Topics.** Topics are given on an experimental one-time-only basis. 3 hours.
298. **Colloquium in History.** Prerequisite: Junior standing. History concentrators and social studies teacher trainees have priority in enrolling for this course. 3 hours. May be repeated as topics vary to a maximum of 6 hours.
300. **Evolutionary and Social Thought Since 1800.** Studies evolutionary theory, the scientific and social contexts in which it has developed, and the inferences drawn from it concerning man's nature and function. 3 hours, or $\frac{1}{2}$ or 1 unit.
301. **History of Poland to 1795.** Comprehensive survey from prehistoric beginnings through the Golden Age to the disappearance of the Polish state; attention to economic, social, and cultural as well as political themes. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
302. **History of Poland Since 1795.** Comprehensive survey of the era of partitions from 1795 to 1918 and of subsequent political independence; attention to economic, social, and cultural as well as political themes. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
303. **The Near and Middle East in the Twentieth Century.** Great power diplomacy, imperialism, nationalism, and problems of modernization studied through coverage of Arab states and Israel, Turkey, and Iran. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
304. **Medieval Civilization.** Same as Religious Studies 304. The architectural, artistic, philosophical, political, and religious components of medieval culture, thought, and

- patterns of behavior; includes monasticism and society and the individual. Prerequisite: Sophomore standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
305. **The Age of the Renaissance.** Same as Religious Studies 305. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **The Age of the Protestant and Catholic Reformation, 1500-1648.** Same as Religious Studies 306. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as Religious Studies 307. The Near East under the Arab caliphs; political, institutional, and intellectual development of Islam. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **The Europeanization of the Near East, 1768-1914.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
309. **Development of Modern Europe: Absolutism and Colonial Expansion, 1648-1789.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Europe in the Age of the French Revolution and Napoleon.** Comparative survey of Western countries in the age of democratic upheavals: America, England, and Prussia as well as France; the rise of Napoleon and the response of Europe; and the fate of innovation and reform in the immediate aftermath of the Napoleonic Wars. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
311. **European History from 1815 to 1871.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
312. **European History from 1871 to 1918.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **European History from 1918 to 1939.** Survey of European society from 1918 to 1939, with emphasis on the impact of World War I, the Russian Revolution, fascism, and the intellectual trends of the twenties and thirties. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
314. **European History from 1939 to the Present.** Survey of European society since 1939, with emphasis on the impact of World War II, the Cold War, the establishment of the welfare state, and social developments. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
315. **Economic and Social History of Europe to 1815.** History and analysis of the development of European economy and society from the Middle Ages to the Industrial Revolution; evolving agrarian systems; growth of commercial economies; industrial and technical progress; and colonial expansion. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
316. **The Industrial Revolution in Europe, 1780-1900.** Comparative analytic study of industrial development in England, France, Germany, and Russia; social, cultural, and demographic consequences of rapid economic change. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **Europe and the World Economy Since 1880.** Economic development of Europe within world economy to the present; topics include imperialism and international finance; World War I and Great Depression; Soviet development; recovery since 1945; and Europe and the underdeveloped world. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Modern European Diplomatic History, 1789-1890.** Diplomatic history of Europe from the French Revolution to the fall of Bismarck. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
319. **Modern European Diplomatic History, 1890 to the Present.** Diplomatic history of Europe from the fall of Bismarck to the present day. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
320. **Russia from the Earliest Times to Peter the Great.** Political, economic, cultural, and social development of Russia during the Kievan and Muscovite periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Russia from Peter the Great to 1855.** Political, economic, cultural, diplomatic, and social development of Russia during Imperial times. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

322. **European History, 1918 to the Present.** Major intellectual, social, economic, and political forces which have shaped the experience of twentieth-century Europeans. Credit is not given for History 322 and either History 313 or 314. Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
323. **Intellectual History of Modern Europe, 1513-1770.** Survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Intellectual History of Modern Europe, 1770 to the Present.** Survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
325. **Intellectual and Cultural History of Russia to 1825.** Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
326. **Intellectual and Cultural History of Russia from 1825 to the Present.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
327. **Russia from 1855 to the Bolshevik Revolution of 1917.** Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
328. **History of Soviet Russia, 1917 to the Present.** The founding and development of the Soviet regime, with emphasis on political, social, and institutional change since the Russian Revolution. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **History of Southeastern Europe from the Fourteenth to the Eighteenth Century.** The Byzantine heritage; the Ottoman conquest and its impact on the peoples of the Balkans; and the internal political and cultural history of the Rumanians, South Slavs, Greeks, and Albanians to 1804. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **History of Southeastern Europe Since 1804.** The rise of nationalism and the formation of national states in the Balkans; the decline of the Ottoman Empire; and the political and cultural history of Rumania, Yugoslavia, Bulgaria, Greece, and Albania in the nineteenth and twentieth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
331. **Medieval Economic and Social History.** Includes the decline of Roman society, the age of localism, the revival of commerce and urbanism, medieval capitalism, and economic decline and social turmoil. 3 hours or 1 unit.
332. **Medieval England.** Economic, intellectual, religious, and social developments as reflected in the art and architecture of medieval England from the time of the German invasions to about the fifteenth century. Prerequisite: Sophomore standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
333. **England under the Tudors and Stuarts, 1485-1660.** Politics, religion, and society in the era of the Protestant Reformation and the Civil War. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
334. **Great Britain Under the Later Stuarts and the Hanoverians, 1660-1815.** Principal political, economic, social, religious, and cultural developments in British history from the Restoration to the end of the Napoleonic wars. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **France, 1815-1900.** The development of France in its various aspects, with special attention to social problems. 3 hours, or $\frac{1}{2}$ or 1 unit.
336. **France, 1900 to the Present.** Political, diplomatic, economic, social, and intellectual developments in France from 1900 to the present. Prerequisite: One year of history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Economic History of American Agriculture.** Same as Agricultural Economics and Economics 337. The development of American agriculture from early colonial times to the present; emphasis on regional development, evolution of methods and equipment,

- trends in marketing and credit, and the making of federal farm policy. Prerequisite: College-level course in basic economics or American history. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **History of Biology.** Same as Biology 338. Development of biological thought from antiquity to the present, emphasizing evolutionary theory and physiology in the nineteenth century and genetics in the twentieth century. Prerequisite: One year of college biology or history, or consent of instructor. 3 hours or 1 unit.
339. **Scientific Thought, I.** Same as Philosophy 317. A historical and critical survey of the development of science and its philosophical interpretation to the death of Newton. 3 hours or 1 unit.
340. **Scientific Thought, II.** Same as Philosophy 318. A historical and critical survey of the development of science and its philosophical interpretation from the death of Newton to the early twentieth century. Prerequisite: Philosophy 317. 3 hours or 1 unit.
341. **Modern Britain: the Victorian Era, 1815-1900.** History of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
342. **Modern Britain Since 1900.** History of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **The Turks and the Ottoman Empire, 1200-1566.** The Seljuk establishment; the Mongols and Ilhanids; Turkish principalities; the rise and conquests of the Ottomans; changing social and economic conditions; foreign relations with special attention to the Mamluks and Safavids; and the Ottoman establishment. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
344. **The High Ottoman Empire, 1566-1924.** The Ottomans and Islamic society; the Ottomans and Mediterranean society; Ottoman foreign relations and the development of diplomacy; the decline and dismemberment of the Empire; and traditional and westernizing attempts at revival. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Constitutional and Legal History of Medieval England.** The origin and development of fundamental English legal and constitutional ideas and institutions in response to changing social needs: the inquest, the grand and petty juries, civil and criminal procedures, and the beginnings of representative government. Valuable for those who intend to study law. Prerequisite: Sophomore standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
346. **Constitutional and Legal History of Modern Britain.** The impact of continuing industrial and social change on English law and the constitution; marriage; civil liberties; from women's burden to women's rights; adaptation of English legal ideas to the American scene; and evolution to the present democracy. Valuable for those who intend to study law. Prerequisite: Sophomore standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
347. **The Age of Charlemagne.** Same as Classical Civilization 347. The age of Charlemagne and its intellectual, political, social, and cultural significance for western Europe. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
348. **Technology in American Life.** General, historical survey, including science and its interaction with American technology; emphasis on sources of technological innovation and the impact of technology on the economy, culture, and thought of America, from the colonial era to the present. 3 hours, or $\frac{1}{2}$ or 1 unit.
349. **The Scientific Revolution, 1543-1727.** Intellectual and social factors involved in the emergence of science in the late sixteenth and seventeenth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **History of American Immigration to 1880.** The migrations which peopled Colonial America and the United States and their role in the shaping of American society and culture; research opportunities provided. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.

351. **History of American Immigration Since 1880.** The migrations of the late nineteenth and twentieth centuries and their impact on American society and culture. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
352. **Colonial Beginnings of American Life and Institutions.** Study of the seventeenth- and eighteenth-century colonies to 1763. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Afro-American Intellectual History.** Africa's importance in Afro-American thought; the ideology of liberation strategies; religion; education; and artistic expression, particularly the Harlem Renaissance, New Deal, and cultural manifestations of the 1960s and 1970s. Prerequisite: History 253 or 254, or one year of American history, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **The Era of the American Revolution, 1763-89.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Federalists, Jeffersonians, and the Era of Good Feeling.** United States history from 1789 to 1828, with emphasis on the conflict between nationalism and sectional interests. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **America in the Age of Jackson.** Political, social, and cultural study of the United States from the 1820s to the 1850s, including the humanitarian reform movements, manifest destiny, and the Mexican War. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **Economic History of the United States, 1775-1860.** Growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. 3 hours, or $\frac{1}{2}$ or 1 unit.
358. **Economic History of the United States Since 1860.** Growth of American economic life and institutions since 1860. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **Civil War and Reconstruction.** The United States between 1850 and 1877, with emphasis on the causes of the war, wartime problems of the North and South, and efforts to create a new Union after the war. 3 hours, or $\frac{1}{2}$ or 1 unit.
360. **History of the United States, 1877-1909.** Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **History of the United States, 1909-32.** Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
362. **History of the United States since 1932.** Discusses the New Deal, the Cold War, all the presidents since Roosevelt, the structure of American imperialism, and America's role in world politics. Prerequisite: One year of college history, political science, or economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
363. **Social History of Industrial America to 1918.** The impact of industrialization, immigration, and urbanization on American society to the end of World War I. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
364. **Social History of Industrial America Since World War I.** Study of the impact of industrial technology, business enterprise, immigration, and urbanization of American society. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
365. **The History of Illinois to 1900.** The development of Illinois, first as a region and then as a state, with emphasis upon its political, economic, social, religious, and cultural growth in the eighteenth and nineteenth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
366. **The History of Illinois in the Twentieth Century.** The development of a modern American state in the twentieth century with emphasis upon its political life, economic growth, social and intellectual problems, and contribution to the nation. Includes Chicago's expanding role in the history of Illinois. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
367. **The Trans-Mississippi West.** The West in American history since the Louisiana Purchase; western stereotypes, order and violence, racial minorities, the urban sector, natural resources, and environmental policy. 3 hours, or $\frac{1}{2}$ or 1 unit.

368. **The South in American History.** Exploration of the history of the American South identifying and explaining differences between the South and the rest of the nation; examines the correlates of economic change in the realms of politics, social structure, and cultural values. Race relations provides a central theme of the course. 3 hours, or $\frac{1}{2}$ or 1 unit.
369. **Constitutional Development of the United States to 1865.** Prerequisite: One year of college history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
370. **Constitutional Development of the United States Since 1865.** Prerequisite: One year of college history or political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
371. **American Intellectual and Cultural History to 1865.** Same as Religious Studies 381. The development of American thought to the mid-nineteenth century, emphasizing the interplay between imported ideas (religious, scientific, political, social, educational, and artistic) and the material and social environment in shaping American life. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
372. **American Intellectual and Cultural History since 1859.** Same as Religious Studies 382. The development of American thought and culture since 1859, emphasizing Darwinism and naturalist thought, religious and cultural events, the impact of science and technology, the American university, and recent cultural conflicts. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
373. **History of American Foreign Relations to 1917.** 3 hours, or $\frac{1}{2}$ or 1 unit.
374. **Imperialism, 1870-1919.** Study of the origins and nature of pre-World War I imperialism, using the comparative approach, with emphasis on Great Britain, the United States, and Japan. Prerequisite: One-year survey course in history. 3 hours, or $\frac{1}{2}$ or 1 unit.
375. **Andean Countries of South America, 1532 to the Present.** The history of Colombia, Ecuador, Peru, Bolivia, and Chile; emphasizes common problems and diverse responses, from the conquest in the sixteenth century to the struggles for development in the twentieth. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
376. **History of Mass Politics in Latin America.** Comparative historical treatment of mass political movements in twentieth-century Latin America stressing Chile, Peru, Brazil, Argentina, Mexico, Bolivia, and Cuba; social science concepts supplement the historical analysis of causes, leaders, followers, programs, tactics, and results of these movements. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
377. **History of Modern Brazil, 1808 to the Present.** Problems of a neocolonial society; themes include family structure, slavery, imperialism, modernization, and the crisis of traditional institutions. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
378. **History of Mexico, 1519 to the Present.** The development of Mexico from the conquest to the postrevolutionary present. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
379. **Slavery and Race Relations in Latin America.** Selected topics on Indians and Spaniards, white and blacks, emphasizing Mexico, the Caribbean, and Brazil. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
380. **Europe and the 'Scramble for Africa.'** Analysis of the politics and economics of the European partition of Africa with particular reference to Britain, France, and Germany (1870-1900) and African responses to alien rule. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
381. **Ancient Greek States.** History of the Greek states from the earliest times to 334 B.C. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Alexander and His Successors.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **History of the Roman Republic to 44 B.C.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.

384. **The Roman Empire.** Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **African Independence and Underdevelopment: 1945 to the Present.** Historical investigation of African political economies based on selected case studies; includes development of the colonial economy, economic bases of African nationalism, and postindependence underdevelopment and attempts to escape from it. Prerequisite: One year of college history or enrollment in the African Studies program. 3 hours, or $\frac{1}{2}$ or 1 unit.
386. **Topics in African History.** Considers specific problems such as traditional histories, social structure and state formation, religious movements, elites and reactions to European occupation, urbanization, nationalism, and the colonial legacy. Prerequisite: One year of college history or enrollment in the African Studies program. 3 hours or 1 unit.
387. **Indian History and Civilization to 1707.** Development of Indian civilization to the British conquest; political evolution, religious and philosophical systems, society, art, and literature during Hindu and Muslim periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
388. **India in the Age of Imperialism.** Western impact on India from 1498 to 1900; rise of British raj; and national awakening and social change in Victorian India. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **India From Ghandi to Independence.** Growth of nationalism, emergence of Muslim separatism, and struggle for independence under Ghandi and Nehru. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
390. **China Under the Ch'ing Dynasty.** The period of Manchu domination in China (1644-1912); emphasis on Chinese reactions to Western influences during the nineteenth century. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
391. **A History of China to 906 A.D.** History of the formative period of the Chinese state, society, and economy. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
392. **A History of China, 907-1644.** History of the early modern Chinese state and society prior to the Western impact. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
394. **Twentieth-Century China.** Chinese state and society in revolutionary transition; emphasis on the Nationalist and Communist revolutions and their results. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
395. **Premodern Japan.** Japanese history from its origins to 1800; evolution of the traditional society, stressing institutional and cultural problems of ancient and "feudal" Japan. 3 hours, or $\frac{1}{2}$ or 1 unit.
396. **Modern Japan.** Japanese history since 1800; institutional and cultural problems connected with modernization; continuity and change in the traditional order; Western pressure; the Meiji restoration; rise and fall of empire; and creation of a modern society. 3 hours, or $\frac{1}{2}$ or 1 unit.
411. **Seminar in Ancient History: Greece.** 1 unit.
413. **Seminar in Ancient History: Rome.** 1 unit.
415. **Seminar in Medieval History.** 1 unit.
417. **Seminar in Renaissance History.** 1 unit.
418. **Seminar in Reformation History.** 1 unit.
419. **Seminar in European History, 1648 to 1815.** 1 unit.
421. **Seminar in European History Since 1815.** 1 unit.
423. **Seminar in English History to 1688.** 1 unit.
425. **Seminar in English and British Empire History Since 1688.** 1 unit.
427. **Seminar in Russian History.** 1 unit.
441. **Seminar in Near and Middle Eastern History.** 1 unit.
443. **Seminar in South Asian History.** 1 unit.
445. **Seminar in East Asian History.** 1 unit.
448. **Seminar in African History.** Prerequisite: History 215, 216, and one upper-level African history course. 1 unit.

- 451. Seminar in Early American History to 1789. 1 unit.
- 453. Seminar in American History Since 1789. 1 unit.
- 461. Seminar in Latin American History. 1 unit.
- 471. Seminar in the History of Science. 1 unit.
- 475. Problems in Ancient History. 1 unit.
- 476. Problems in Medieval History. 1 unit.
- 477. Problems in Early Modern European History, 1300-1815. 1 unit.
- 478. Problems in European History since 1815. 1 unit.
- 479. Problems in English History before 1688. 1 unit.
- 480. Problems in English History since 1688. 1 unit.
- 481. Problems in Russian History. 1 unit.
- 482. Problems in Near and Middle Eastern History. 1 unit.
- 483. Problems in Chinese History. 1 unit.
- 484. Problems in Japanese History. 1 unit.
- 485. Problems in South Asian History. 1 unit.
- 486. Problems in American History to 1830. 1 unit.
- 487. Problems in American History since 1815. 1 unit.
- 488. Problems in Latin American History. 1 unit.
- 496. History of Historiography. Introduction to the great historians from early times to the present. 1 unit.
- 497. Reading Course. Directed reading in special fields. Open only to students with a master's degree or equivalent, who are preparing for the preliminary examination in history and who need instruction in areas not provided by current course offerings. Prerequisite: Master's degree or equivalent; consent of instructor. 1 unit.
- 498. Problems in the Teaching of College History. Prerequisite: Candidate for Ph.D. degree in history. ½ unit.
- 499. Thesis Research. Individual direction in research and guidance in writing theses for advanced degrees. 0 to 4 units.

Humanities

Director of School: Professor N. Baym

School Office: 210 Lincoln Hall, Urbana

- 151. **The Humanities in Western Culture.** Comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought; emphasis on history and the novel: for example, Well's *Outline of History*, Thucydides, *Third and Fourth Kings* (Knox version), *The Odyssey*, *Don Quixote*, and *The History of Tom Jones*. Prerequisite: Sophomore standing, James Scholar freshman, or freshman standing with exemption from Rhetoric 105. 4 hours.
- 152. **The Humanities in Western Culture.** Comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought; emphasis on drama, philosophic essay, and poetry: for example, Sophocles, Shakespeare, Plato, Nietzsche, St. Augustine, Ecclesiastes, the New Testament, and Whitman. Prerequisite: Humanities 151. 4 hours.
- 199. Undergraduate Open Seminar. 1 to 5 hours. May be repeated.
- 211. **The Growth of American Culture, I.** Social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
- 212. **The Growth of American Culture, II.** Social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.
- 215. **Literature and Other Arts, I.** Consideration of literature and other arts in the context

of a particular historical period, and in relationship to the movement of ideas within that period. Prerequisite: Junior standing or consent of instructor. 3 hours.

216. **Literature and Other Arts, II.** Continuation of Humanities 215. Prerequisite: Humanities 215. 3 hours.
290. **Individual Study.** Supervised reading and research on interdisciplinary humanities topics chosen by the student in consultation with a faculty member. Prerequisite: Consent of director of School of Humanities. 2 to 4 hours. May be repeated to a maximum of 8 hours.
292. **Senior Thesis.** Individual research for concentrators in humanities leading to the completion of a thesis. Prerequisite: Senior standing, consent of director of School of Humanities, and a declared option in humanities field of concentration. 2 to 4 hours. May be repeated to a maximum of 8 hours.
295. **Special Topics: Interdisciplinary.** Interdisciplinary topics in the humanities; topics vary, but are normally related to one of the options in the humanities field of concentration. Prerequisite: Declared option in humanities field of concentration or consent of director of School of Humanities; consent of instructor. 3 hours. May be repeated as topics vary; students may register for two different topics in the same semester.
297. **Special Topics: Junior Seminar and Tutorial.** Interdisciplinary seminar and tutorial in selected topics related to one of the options in the humanities field of concentration. Prerequisite: Declared option in humanities field of concentration; junior standing; and consent of instructor. 3 hours. May be repeated to a maximum of 6 hours.
298. **Special Topics: Senior Seminar and Tutorial.** Interdisciplinary seminar and tutorial in selected topics related to one of the options in the humanities field of concentration. Prerequisite: Declared option in humanities field of concentration; senior standing; consent of instructor; and Humanities 297. 3 hours. May be repeated to a maximum of 6 hours.
382. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, French, German, Slavic, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or ½ or 1 unit.

Linguistics

(Including Arabic, Hebrew, Hindi, Modern Hebrew, Persian, Swahili, and Yoruba)

Head of Department: Professor B. B. Kachru

Department Office: 4088 Foreign Languages Building, Urbana

ARABIC

201. **Elementary Arabic, I.** An introduction to Arabic in one of its standard national forms; includes conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. All students in this course are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Arabic, II.** Second term of spoken Arabic; includes conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor; formal grammar based on conversational materials; and work on written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 201. 5 hours.
303. **Intermediate Arabic, I.** First term of second year of the Arabic language, with drill for more advanced conversational fluency; introduction to a greater variety of styles and

levels of discourse and usage; and increasing study of written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 202 or equivalent. 5 hours or 1 unit.

304. **Intermediate Arabic, II.** Concentration on ability to engage in reasonably fluent discourse in Arabic, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Arabic, I.** Reading selections from literary works; selections from political, social, historical, and economic writings. Prerequisite: Arabic 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Arabic, II.** Continuation of Arabic 305. Further reading in literary sources as well as in history, economics, and politics. Prerequisite: Arabic 305 or equivalent. 5 hours or 1 unit.

HEBREW

110. **Introduction to Biblical Hebrew.** Same as Religious Studies 108. Stress on mastery of grammar, reading, writing, and simple prose composition; reading of simple Biblical prose. 4 hours.
111. **Introduction to Biblical Hebrew.** Same as Religious Studies 109. Syntax and reading of simple classics' prose narrative. Prerequisite: Hebrew 110 or Religious Studies 108. 4 hours.
210. **Biblical Prose.** Same as Religious Studies 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Hebrew 110 and 111, or Religious Studies 108 and 109. 4 hours.
311. **Hebrew Poetry.** Same as Religious Studies 311. Translation and analysis of ancient Hebrew poetry, with emphasis on the development of Hebrew prosodic style and on textual criticism; research paper required for graduate credit. Prerequisite: Religious Studies 210 or equivalent. 4 hours or 1 unit.

HINDI

201. **Elementary Hindi/Urdu, I.** An introduction to the Hindi/Urdu language; includes conversation with a native Hindi/Urdu-speaking tutor under the direction of a linguist instructor, and a minimum of formal grammar and Devanagari writing; introduction to Arabic-Persian script by arrangement. All students are required to register for one hour per week in the language laboratory. 5 hours.
202. **Elementary Hindi/Urdu, II.** Second term of spoken Hindi/Urdu; includes conversation with a native Hindi/Urdu-speaking tutor under the direction of a linguist instructor, formal grammar based on conversational materials, and work on written Hindi; concentration on written Urdu by arrangement. All students are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 201. 5 hours.
301. **Intensive Hindi, I.** An intensive course on the Hindi language including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor; study of the formal grammar and the Devanagari script. 10 hours or 2 units.
302. **Intensive Hindi, II.** Includes drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; increasing study of the written language and more formal grammar; and concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students are required to

- register for one hour per week in the language laboratory. Prerequisite: Hindi 301 or equivalent, or consent of instructor. 10 hours or 2 units.
303. **Intermediate Hindi, I.** First term of second year of the Hindi language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Hindi, II.** Concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Hindi, I.** A course for advanced knowledge of spoken and written Hindi. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. Prerequisite: Hindi 304 or consent of instructor. 5 hours or 1 unit.
306. **Advanced Hindi, II.** A course for advanced knowledge of spoken and written Hindi with emphasis on modern Hindi literature and language. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. Prerequisite: Hindi 305 or consent of instructor. 5 hours or 1 unit.
307. **Advanced Hindi, III.** A course for detailed analysis of formal grammar of Hindi with concentration on readings from Hindi literature. Prerequisite: Hindi 306 or consent of instructor. 5 hours or 1 unit.
308. **Advanced Hindi, IV.** A survey of the history of Hindi literature and readings from different periods of Hindi literature. Prerequisite: Hindi 307 or consent of instructor. 5 hours or 1 unit.
309. **Readings in Hindi Literature in Translation.** Introduction to Hindi literature since 1400 A.D.; concentration on major works in poetry and prose available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit.
310. **Readings in Hindi Literature in English Translation.** Introduction to Hindi literature of the modern period; concentration on major works in poetry, prose, and novel available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit.

LINGUISTICS

198. **Freshman Seminar.** Special seminar for honors students on linguistic theory, methodology, and application. Prerequisite: James Scholar standing or other designation as a superior student. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Introduction to Language Science.** Same as Anthropology 200. An introduction to the theory and methodology of general linguistics; includes the various branches and applications of linguistics. 3 hours.
201. **Elements of Phonology.** Introduction to the formal description of phonological structure, including study of articulatory phonetics, the phonological feature framework, and fundamental concepts of generative phonological theory. Prerequisite: Credit or concurrent registration in Linguistics 200, or consent of instructor. 3 hours.
202. **Elements of Syntax.** Introduction to the types of syntactic and semantic phenomena found in natural language, with material drawn from a variety of languages; emphasis on the implications of such phenomena for linguistic theory; formalism and application of generative grammar. Prerequisite: Credit or concurrent registration in Linguistics 200, or consent of instructor. 3 hours.
220. **Language in African Culture and Society.** Introduction to the sociolinguistic context of Africa; special emphasis on the study of selected African languages for understand-

- ing the African cultural heritage; and a critical discussion of African oral literary tradition, language variety, language attitude, language standardization, and other linguistically relevant language problems. 3 hours.
225. **Elements of Psycholinguistics.** Introduction to the theory and methodology of psycholinguistics with emphasis on language acquisition and linguistic behavior. 3 hours.
232. **Sex-related Differences in Language.** Same as Speech Communication 232. A survey of perceived and actual differences between the uses of language by men and by women; emphasizes vocal language, although some attention is given to written expression. Prerequisite: A course in speech communication or in linguistics, or equivalent. 3 hours.
300. **Introduction to Linguistic Structure.** Same as Anthropology 300. Introduction to the theory and methodology of the science of linguistics with special reference to phonology and syntax. 3 hours or ½ unit.
301. **Introduction to General Phonetics.** Introduction to the main branches of general phonetics and phonological theory; emphasis on analysis of non-Western languages and research techniques. 3 hours or ½ unit.
302. **Introduction to Historical Linguistics.** Introduction to the theory and methodology of historical linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent, or consent of instructor. 3 hours or ½ unit.
303. **Non-Western Linguistic Structures.** Intensive study of linguistic structure of a selected non-Western language. 3 hours or 1 unit. With consent of instructor, this course may be repeated for credit.
304. **Tutorials in Nonwestern Languages.** Advanced or intensive language instruction in a selected nonwestern language; does not cover instruction in East or Southeast Asian languages. Prerequisite: Consent of instructor. 1 to 5 hours, or ½ to 1 unit. May be repeated with consent of instructor.
305. **Introduction to Applied Linguistics.** Same as English as a Second Language 305. Introduction to the applications of general linguistic theory to the specific fields of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign and second languages; practical assignment work. Prerequisite: Consent of instructor. 3 hours, or ½ or 1 unit.
306. **Introduction to Computational Linguistics.** Introduction to the use of computers in grammatical rule testing, computer-assisted language instruction, experimental phonetics, historical and comparative linguistics, quantitative study of language, and stylistic analysis; includes SNOBOL programming language, PLATO, dialectology, and automatic translation. Prerequisite: Linguistics 300 and Computer Science 106, or consent of instructor. 3 hours or 1 unit.
307. **Introduction to Mathematical Linguistics.** Same as Anthropology 307. Principles of set theory, logic and formal systems, group theory, and automata theory; introduction to the formal theory of grammars. Prerequisite: Linguistics 300. 3 hours or 1 unit.
308. **Comparative Grammar of Greek and Latin.** Same as Greek 308 and Latin 308. Historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or concurrent registration in Greek 202. 3 hours or ¾ unit.
309. **Introduction to Indo-European Linguistics.** Same as Greek 310 and Latin 310. Introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction; principles of comparative phonology and introductory survey of morphology; and discussion of theories about the original home, culture, and society of the Indo-Europeans. Prerequisite: Fulfillment of the language requirement of the College of Liberal Arts and Sciences. 3 hours or 1 unit.
310. **Topics in Indo-European Linguistics.** Principles of Indo-European morphology; paper and discussion on selected topics of Indo-European linguistics such as phonology, morphology, migrations, and antiquities. Prerequisite: Linguistics 309 or equivalent. 3 hours or 1 unit.

311. **The Structure of Greek and Latin.** Same as Greek 309 and Latin 309. Linguistic analysis of the morphology and syntax of the Greek and Latin languages. Prerequisite: Credit or concurrent registration in Greek 202 and Latin 202, or their equivalent. 3 hours or $\frac{3}{4}$ unit.
316. **Structure of the French Language.** Same as French 316. General survey of the linguistic structure of modern standard French including phonology, morphology, and syntax; emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or $\frac{3}{4}$ unit.
320. **Introduction to African Linguistics.** Introduction to genetic and typological classification of the main language families of Africa; concentration on grammatical and phonological characteristics. Prerequisite: Linguistics 200 or 300; consent of instructor. 3 hours or 1 unit.
325. **Introduction to Psycholinguistics.** Same as Communications 325. Introductory survey of psychological and linguistic approaches to the study of communication. Credit is not given for both Psychology 325 and Linguistics 325. Prerequisite: Credit or concurrent registration in Linguistics 300. 3 hours or 1 unit.
330. **Introduction to Far Eastern Linguistics.** Same as Chinese, Japanese, and Korean 330. Introduction to genetic relation of the Far Eastern languages with other languages; concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
338. **Philosophies of Language.** Same as Philosophy 338. Study of the development of philosophical problems about language and their treatment from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **History of Linguistics.** Survey of linguistic theories from ancient to modern times; special emphasis on comparative grammar and the development of structural linguistics; and extended discussion of at least one other period. 3 hours or 1 unit.
350. **Sociolinguistics.** Same as English as a Second Language 350. Critical study of the sociologically oriented general linguistic theories; special reference to language varieties, language attitudes, language diversity, language standardization, linguistic geography, and language and political roles (language loyalty); emphasis on research methodology and techniques. Prerequisite: Introductory course in linguistics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Spanish Structure.** Same as Spanish 353. Comprehensive analysis of Spanish phonology and syntax based on present-day linguistic theory. Prerequisite: Linguistics 300; Spanish 351; Spanish 352. 3 hours or $\frac{1}{2}$ unit.
360. **Introduction to South Asian Linguistics.** Introduction to genetic and typological classification of the main language families of South Asia; concentration on phonology or syntax. Topics vary. 3 hours or 1 unit. May be repeated to a maximum of 6 hours or 2 units with consent of instructor.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Portuguese, Romance Linguistics, and Spanish 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
367. **Introduction to Germanic Linguistics.** Same as Germanic 367. Comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent; some knowledge of German desirable. 2 hours or $\frac{1}{2}$ unit.
370. **Language, Culture, and Society.** Same as Anthropology 370 and Communications 370. Examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. Prerequisite: Anthropology 230 or one course in communications or linguistics, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
375. **Speech Science, I.** Same as Speech and Hearing Science 375 and Speech Communication 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms and to fundamental acoustics of speech. Prerequisite:

- site: Speech and Hearing Science 109 or 301, or consent of instructor. 4 hours or 1 unit.
376. **Speech Science, II.** Same as Speech and Hearing Science 376 and Speech Communication 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Linguistics 375. 4 hours or 1 unit.
380. **Introduction to Slavic Linguistics.** Same as Slavic 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or $\frac{3}{4}$ unit.
382. **Introduction to Sanskrit Linguistics, I.** The sounds and alphabet of Sanskrit; introduction to grammar, with drill and readings; and sandhi rules. Reading: *Nala* and *Damayanti*. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.
383. **Introduction to Sanskrit Linguistics, II.** Further grammar and reading; consideration of Sanskrit from one or more of the following points of view: (a) comparative Indo-European linguistics, (b) Indology, (c) Paninian linguistics, (d) Western linguistic theories, and (e) transformational-generative grammar. Prerequisite: Linguistics 382. 3 hours or 1 unit.
386. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, French, German, Humanities, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
387. **The Structure of English.** Critical evaluation of traditional and structuralist grammatical descriptions; introduction to transformational grammatical studies; detailed survey of a transformational syntax of English; and brief introduction to generative phonology and morphophonemic analysis of English, especially stress. 3 hours or $\frac{3}{4}$ unit.
388. **Linguistics in Language Learning, I.** Same as English as a Second Language 388. Application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
389. **Linguistics in Language Learning, II.** Same as English as a Second Language 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the applications of some principles of psycholinguistics, sociolinguistics, and ethno-linguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
400. **Introduction to General Linguistics.** Same as Anthropology 400 and English as a Second Language 402. Introduction to the linguistic sciences; linguistic theory and methodology; and branches of linguistics and their application. 1 unit. Credit may not be applied toward a graduate degree in linguistics.
401. **Syntax.** Critique of traditional and contemporary theories of syntactic structure; systematic introduction to transformational grammar. Prerequisite: Linguistics 300 or equivalent. 1 unit.
402. **Phonology.** Examination of language-specific phonological problems with a view toward formulating a language-independent theory of phonology. Prerequisite: Linguistics 301 or consent of instructor. 1 unit.
403. **Seminar in Linguistic Analysis.** Discussion of advanced topics of current interest in descriptive linguistics. Prerequisite: Linguistics 401. 1 unit. May be repeated for credit with consent of instructor.
404. **Practicum.** Classroom- and homework-solving of assorted problems in syntactic and phonological analysis of many languages. Prerequisite: Linguistics 401 and 402. 1 unit.
405. **Seminar in Stylistics.** Seminar designed to evaluate and discuss earlier and current linguistically motivated stylistic theories; emphasis on the theoretical and methodological problems in application of linguistics to stylistic analysis of literary texts. Prerequisite: Linguistics 300 or 305; consent of instructor. 1 unit.

407. **Advanced Topics in Mathematical Linguistics.** The hierarchy of automata and the hierarchy of grammars; equivalence theorems and undecidability theorems; and recognition procedures. Prerequisite: Linguistics 307 or equivalent. 1 unit.
408. **Russian Phonology.** Same as Russian 408. The sound pattern of Russian in its synchronic and diachronic aspects. Prerequisite: Consent of instructor. 1 unit.
411. **Methods in Historical Linguistics.** Advanced analysis of genetic comparison and reconstruction, linguistic borrowing, linguistic geography, etymology, and related topics. Prerequisite: Linguistics 302. 1 unit.
412. **Research Seminar in Historical Linguistics.** Research work in etymology, linguistic geography, and historical syntax. Prerequisite: Linguistics 411 or consent of instructor. 1 unit.
419. **Contrastive Linguistics.** Same as English as a Second Language 419. Critical survey of contemporary linguistic models; special reference to their relevance in preparing contrastive analyses of languages; and detailed discussion on contrastive analysis of English and selected non-Western languages at different linguistic levels. Prerequisite: Linguistics 300 or consent of instructor. $\frac{1}{2}$ or 1 unit.
420. **Linguistic Phonetics.** Principles of scientific description of the phonic aspect of language; distinctive features and phonetic alphabets; relations between phonetics and other linguistic levels; and inventory of speech sounds. Prerequisite: Linguistics 301 or equivalent. 1 unit.
421. **Seminar in Phonetic Theories.** Theories of speech production; motor theory and linguistic change; acoustical correlates of vocal-tract configurations; theories of speech perception; and a model of universal phonetics. Prerequisite: Linguistics 301 or equivalent. 1 unit.
424. **Developmental Psycholinguistics.** Same as Communications 424 and Psychology 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Communications 425 and Psychology 425. Critical survey of methods and theories in the psychological study of the communication process with emphasis upon linguistic approaches, information-theory and learning-theory approaches, psycholinguistic analysis of language decoding and encoding, and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Communications 426 and Psychology 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course are expected to plan, execute, and report an original piece of research in this area. Prerequisite: Linguistics 425; consent of instructor. $\frac{1}{2}$ or 1 unit.
429. **Second Language Acquisition and Bilingualism.** Same as Psychology 429. Examination of the field from a psycholinguistic perspective; topics discussed include first versus second language acquisition; the nature of language aptitude and competence; methods of second language teaching; the nature of bilingualism; and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit.
440. **Seminar in History of Linguistics.** Analysis of recent theoretical approaches. Prerequisite: Linguistics 340. 1 unit.
441. **Syntax, II.** Advanced analysis and critique of syntactic descriptions, with special attention to implications for universal grammar. Prerequisite: Linguistics 401 or consent of instructor. 1 unit.
442. **Phonology, II.** Continuation of Linguistics 402. Prerequisite: Linguistics 402. 1 unit.
450. **Linguistics and the Study of Meaning.** Consideration of those aspects of meaning which are the concern of linguistic theory. Prerequisite: Linguistics 300. 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Portuguese, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Linguistics 362 and consent of instructor. 1 unit.

475. **Experimental Phonetics, I.** Same as Speech and Hearing Science 475. Theoretical consideration of speech as motor behavior; special reference to physiological investigations of normal respiration, phonation, and articulation; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
476. **Experimental Phonetics, II.** Same as Speech and Hearing Science 476. Theoretical consideration of speech as an acoustical phenomenon; special reference to acoustical investigations of voice and speech sounds; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
477. **Measurement of Speech, I.** Same as Speech and Hearing Science 477. Principles and methods of measuring speech action; special action recorders and transducers; techniques of analysis; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Linguistics 475. 1 unit.
478. **Measurement of Speech, II.** Same as Speech and Hearing Science 478. Principles and methods of measuring the acoustical phenomena of speech; oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Linguistics 476. 1 unit.
481. **Topics in Syntactic Theory.** Investigation of syntactic universals; recent developments in the theory of syntax. Prerequisite: Linguistics 387 or 401; consent of instructor. 1 unit.
482. **Topics in Phonological Theory.** Continuation of Linguistics 402; special topics and individual papers assigned. Prerequisite: Linguistics 402 or equivalent. 1 unit.
490. **Special Topics in Linguistics.** Individual studies in the areas of linguistics not covered by regular course offerings. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** 0 to 4 units.

MODERN HEBREW

201. **Elementary Modern Hebrew, I.** Introduction to Hebrew; includes conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. Students are required to register for one hour weekly in the language laboratory. 5 hours.
202. **Elementary Modern Hebrew, II.** Continuation of Modern Hebrew 201, with introduction of more advanced grammar, and with emphasis on more fluency in speaking and reading. Prerequisite: Modern Hebrew 201. 5 hours.
303. **Intermediate Modern Hebrew, I.** First term of the second year of the Hebrew language, including drill for more advanced conversational fluency, increased study of the written language, and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 202 or equivalent. 5 hours or 1 unit.
304. **Intermediate Modern Hebrew, II.** Concentration on ability to engage in reasonable fluent discourse in Hebrew, comprehensive knowledge of formal grammar, and an ability to read ordinary written Hebrew. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 303 or equivalent. 5 hours or 1 unit.
305. **Advanced Modern Hebrew, I.** Advanced spoken and written standard modern Hebrew; introduction to modern Hebrew literature. Prerequisite: Modern Hebrew 304 or equivalent. 3 to 5 hours or $\frac{3}{4}$ to 1 unit.
306. **Advanced Modern Hebrew, II.** A course for advanced knowledge of spoken and written standard Modern Hebrew with emphasis on Modern Hebrew literature and language. Prerequisite: Modern Hebrew 305 or equivalent. 3 to 5 hours, or $\frac{3}{4}$ to 1 unit.

307. **Topics in Modern Hebrew Language and Literature, I.** Selected readings from modern Hebrew authors, with emphasis on the novel and short story; lectures and discussions on Hebrew literature and aesthetics; and detailed analysis of formal Hebrew grammar. Prerequisite: Modern Hebrew 306 or consent of instructor. 3 hours or $\frac{3}{4}$ unit. May be repeated with consent of instructor.
308. **Topics in Modern Hebrew Language and Literature, II.** Selected readings from modern Hebrew authors, with special emphasis on Eastern European Revival literature; lectures and discussions on Hebrew literature and aesthetics; and detailed analysis of formal Hebrew grammar. Prerequisite: Modern Hebrew 307 or consent of instructor. 3 hours or $\frac{3}{4}$ unit. May be repeated with consent of instructor.

PERSIAN

201. **Elementary Persian, I.** Introduction to Persian, including conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. 5 hours.
202. **Elementary Persian, II.** Continuation of Persian 201, with introduction of more advanced grammar and with emphasis on more fluency in speaking and reading. Prerequisite: Persian 201 or equivalent. 5 hours.
205. **Introduction to Persian Culture and Literature, I.** A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
206. **Introduction to Persian Culture and Literature, II.** Continuation of Persian 205. A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours.
303. **Intermediate Persian, I.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 202. 5 hours or 1 unit.
304. **Intermediate Persian, II.** A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 303. 5 hours or 1 unit.
305. **Advanced Persian, I.** Designed to improve competence in speaking, writing, and reading Persian; includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 304. 3 hours or 1 unit.
306. **Advanced Persian, II.** Continuation of Persian 305. Designed to improve competence in speaking, writing, and reading Persian; includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 305. 3 hours or 1 unit.

SWAHILI

201. **Elementary Swahili, I.** Same as African Studies 201. Beginning spoken Swahili with minimum of formal grammar; conversation with a native Swahili tutor under the supervision of a linguist-instructor. 5 hours.
202. **Elementary Swahili, II.** Same as African Studies 202. Second semester of spoken Swahili; more conversation with a native tutor; and further grammar. Prerequisite: Swahili 201. 5 hours.
303. **Intermediate Swahili, I.** Same as African Studies 303. Second-year Swahili with emphasis on developing conversational fluency; some readings on Swahili culture and customs. Prerequisite: One year of Swahili. 5 hours or 1 unit.
304. **Intermediate Swahili, II.** Same as African Studies 304. More of second-year Swahili with emphasis on conversational fluency; some readings in Swahili literature. Prerequisite: One year of Swahili. 5 hours or 1 unit.

305. **Advanced Swahili, I.** Same as African Studies 305. Third-year Swahili with emphasis on conversational fluency and on increased facility in reading Swahili texts, including current newspaper prose and (East) African culture materials. Prerequisite: Swahili 304 or equivalent. 5 hours or 1 unit.
306. **Advanced Swahili, II.** Same as African Studies 306. Third-year Swahili with emphasis on conversational fluency and on increased facility in reading Swahili texts, including current newspaper prose and (East) African culture materials. Prerequisite: Swahili 305 or equivalent. 5 hours or 1 unit.

YORUBA

201. **Elementary Yoruba, I.** Same as African Studies 205. An introduction to Yoruba; includes conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor, and essentials of formal grammar. All students are required to register for three hours per week in the language laboratory. 5 hours.
202. **Elementary Yoruba, II.** Same as African Studies 206. Second term of spoken Yoruba; includes conversation with a native Yoruba-speaking tutor under the direction of a linguist-instructor; and further formal grammar based on conversational materials. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 201 or consent of instructor. 5 hours.
303. **Intermediate Yoruba, I.** Same as African Studies 307. Continued study of Yoruban grammar with emphasis on developing conversational fluency; readings on Yoruban culture and current affairs. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 202 or consent of instructor. 5 hours or 1 unit.
304. **Intermediate Yoruba, II.** Same as African Studies 308. Concentration on attaining conversational fluency; further readings in Yoruban newspapers and magazines and simpler portions from contemporary Yoruban plays and novels. All students are required to register for three hours per week in the language laboratory. Prerequisite: Yoruba 303 or consent of instructor. 5 hours or 1 unit.

Philosophy

Acting Chairperson of Department: Professor F. W. Neely
Department Office: 105 Gregory Hall, Urbana

101. **Introduction to Philosophy.** 3 hours.
102. **Logic.** Reasoning, detection of fallacies, and evidence. 3 hours.
103. **Ethics and Social Policy.** An examination of the moral aspects of social problems, and a survey of ethical principles formulated to validate social policy. Credit is not given for both Philosophy 103 and 105. 4 hours.
104. **Philosophy of Democracy.** An examination of the philosophical bases of democracy and some of its opponents. 4 hours.
105. **Introduction to Ethics.** Some basic questions of ethics, discussed in the light of influential ethical theories and with reference to specific moral problems, such as: what makes an action morally right? are moral standards absolute or relative? what is the relation between personal morality and social morality, and between social morality and law? 3 hours. Credit is not given for both Philosophy 105 and 103.
110. **World Religions.** Same as Religious Studies 110. Survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. 3 hours.

198. **Freshman Seminar.** Investigation of selected fundamental topics of philosophical inquiry. See *Timetable* for current topics. Prerequisite: Freshman James Scholar. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
202. **Logic, Semantics, and Critical Thinking.** An intensive study of basic deductive and inductive inference, the varieties and vagaries of meaning, fallacies in reasoning, and related topics, with special emphasis on the analysis and criticism of argumentative writing. 4 hours. Students may not receive credit for both Philosophy 202 and 102.
205. **Recent European Philosophy.** Introduction to the major recent philosophical movements in Europe, such as phenomenology, existentialism, philosophical anthropology, and neo-Marxism. 3 hours.
210. **Ethics.** Problems in ethical theory; the nature of right and wrong, justice, conscience, moral feelings, etc. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Religious Studies 230. A critical study of theories about the nature of religion. 3 hours.
250. **Philosophical Conceptions of Human Nature.** A comparative examination of important historical and contemporary conceptions of human nature. 3 hours.
270. **Philosophy of Science.** Investigation of the nature of scientific knowledge by examining archetypal examples from physical science (e.g., Ptolemaic and Copernican astronomy); nature of scientific truth, validation of theories, nature of scientific theories, evolution of theories, experimental procedure, role of presuppositions, scientific revolutions, etc. 3 hours.
290. **Individual Study.** Readings in selected philosophical topics. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to juniors and seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. May be repeated for a maximum of 4 hours.
292. **Thesis.** Special training in philosophical investigation. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. May be repeated for a maximum of 4 hours.
298. **Senior Seminar.** Seminar on selected philosophical topics. Prerequisite: Open to senior philosophy concentrators with a general grade-point average of 4.0 only with consent of instructor. 3 hours. May be repeated for a maximum of 6 hours.
303. **History of Ancient Philosophy.** A survey primarily of the Greeks, dealing with such topics as knowledge, metaphysics, ethics, theory of nature, and mysticism. 4 hours or 1 unit.
304. **History of Medieval Philosophy.** Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **History of Modern Philosophy.** 4 hours or 1 unit.
307. **History of Modern Philosophy.** Bacon, Hobbes, Locke, Berkeley, and Hume. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
308. **History of Modern Philosophy.** Descartes, Spinoza, Leibniz, and Kant. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
309. **The Philosophy of Plato.** Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit.
310. **The Philosophy of Aristotle.** An intensive study of major works in Aristotle or of some aspect of his philosophy. Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit.
311. **Nineteenth Century Philosophy.** Prerequisite: One course in philosophy (preferably Philosophy 101 or 306). 3 hours, or $\frac{3}{4}$ or 1 unit.
312. **Classical Modern Philosophers.** Intensive study of one, or in special cases, two major philosophers of the period 1600-1900, e.g., Descartes, Hume, Kant, or Hegel. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.

313. **American Philosophy.** The history of philosophy in America from colonial times to the present. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
316. **Anglo-American Philosophy Since 1900.** Introduction to the major philosophical developments in England and America in the present century, focusing on such writers as G. E. Moore, Bertrand Russell, A. J. Ayer, Ludwig Wittgenstein, and W. V. Quine. Prerequisite: One course in philosophy. 3 hours or 1 unit.
317. **Scientific Thought, I.** Same as History 339. A historical and critical survey of the development of science and its philosophical interpretation to the death of Newton. 3 hours or 1 unit.
318. **Scientific Thought, II.** Same as History 340. A historical and critical survey of the development of science and its philosophical interpretation from the death of Newton to the early twentieth century. Prerequisite: Philosophy 317. 3 hours or 1 unit.
321. **Ethics and Value Theory.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
322. **Recent Developments in Ethics.** Ethical theories of the last fifty years; intuitionism, naturalism, pragmatism, emotivism, existentialism, and analytic ethics. Prerequisite: Philosophy 103, 105, or 321. 3 hours, or $\frac{3}{4}$ or 1 unit.
323. **Philosophy of Art.** 3 hours, or $\frac{3}{4}$ or 1 unit.
324. **Philosophy of Religion.** Same as Religious Studies 362. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their modern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
325. **Philosophy of Mind.** Philosophical problems arising in connection with mental phenomena; the relation of mind and body; free will and determinism; our knowledge of other minds; and the self and personal identity. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
326. **Metaphysics.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
329. **The Philosophy of Social Science.** Same as Anthropology 329 and Sociology 325. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
330. **Theory of Knowledge.** The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism; and other selected contemporary topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Analytic Philosophy.** Advanced treatment of problems of knowledge and method, and introduction to contemporary techniques of philosophical analysis; meaning and verification; inductive and deductive method; perceptual knowledge; certainty; and other selected topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Perception and Knowledge.** A systematic study of basic problems in the philosophy of perception; perceiving as a mental state; the objects of perception; sensing, sensation, and sensedata; perception and the external world; and perception as the basis for empirical knowledge. Traditional empiricist philosophies of perception are examined, and contemporary criticisms and defenses are assessed. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
333. **Symbolic Logic.** Study of the elementary principles of symbolic analysis as applied to logical problems. 3 hours, or $\frac{3}{4}$ or 1 unit.
334. **Symbolic Logic.** A general study of the more refined methods of symbolic analysis as applied to logical problems; particular attention to proof procedures as they relate to the question of consistency and completeness. Prerequisite: Philosophy 333. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Social Philosophy.** Selected topics from the nature of social organization, nature and convention, utility, justice, equality, liberty, rights, and duties. Prerequisite: Philosophy 103, 105, or 321, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

336. **Philosophy of Law and of the State.** Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
337. **Semantics.** An investigation of semantical concepts such as denoting and truth; a study of the functions of language; definition, meaning and verification, and semantical paradoxes. Prerequisite: A course in logic. 3 hours, or $\frac{3}{4}$ or 1 unit.
338. **Philosophies of Language.** Same as Linguistics 338. Study of the development of philosophical problems about language and their treatment from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
339. **Philosophy of Mathematics.** Introduction to some of the main philosophical problems and contemporary viewpoints concerning mathematical concepts, mathematical methods, and the nature of mathematical truths; the concept of infinity; conventionalism and formalism; the distinction between analytic and synthetic truths; necessity; mathematics and the problem of universals; and other related topics. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
340. **The Philosophy of Alfred North Whitehead.** Examination of the mature thought of A. N. Whitehead, primarily as contained in *Process and Reality* and *Adventures of Ideas*, taking into account both the cosmological scheme and the application of his technical philosophy to social philosophy, to ethics, and to philosophy of religion. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
341. **Existential Philosophy.** Study of a selection of the major writings of the more important existential philosophers, e.g., Heidegger, Jaspers, and Sartre. Prerequisite: One course in philosophy (preferably Philosophy 311), or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
343. **Phenomenology.** Study of the development of phenomenology from Husserl to the present. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
345. **Marxist Philosophy.** Examination of the philosophical writings of a number of Marxist writers, from Marx himself to such neo-Marxists as Schaff, Petrovic, Sartre, and Marcuse. 3 hours, or $\frac{3}{4}$ or 1 unit.
353. **Formal Logic: Advanced Survey.** Techniques and results of symbolic logic, with special attention to topics of philosophical importance. Prerequisite: Philosophy 102, graduate standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
355. **Inductive Logic.** Philosophical foundations of probability theory; formal development and applications of the frequency and logical, and subjective interpretations to the philosophical problems of induction and confirmation. Prerequisite: Philosophy 333 or 353, or Mathematics 410, or consent of instructor. 3 hours or 1 unit.
361. **Comparative Religion.** A comparative study of classical high religions. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Contemporary Religious Thought.** Same as Religious Studies 369. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "neoorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
369. **Indian Philosophy.** Survey of Indian philosophy; emphasizes readings in the fundamental texts of Indian thought; and develops basic familiarity with the wide range of Indian philosophies and theologies. Prerequisite: A previous course in philosophy, Religious Studies 297, or History 387. 3 hours, or $\frac{3}{4}$ or 1 unit.
371. **Philosophy of Science II: Contemporary Issues.** A comprehensive survey of the main developments in philosophy of science this century; concentration on the views of logical positivism, subjectivism, and scientific realism; and topics including the nature of theories, laws and counter-factuals, inductive logic and confirmation theory, experimental methodology, concept formation, and scientific revolutions. Prerequisite: Philosophy 270 or consent of instructor. 3 hours or 1 unit.
403. **Seminar in Medieval Philosophy.** 1 unit. May be repeated for credit.
405. **Seventeenth-Century Continental Thought (Descartes, Spinoza, Leibniz).** Study of the basic philosophical works of the three leading continental thinkers of the century. 1 unit. May be repeated for credit.

- 407. **British Empiricism.** 1 unit. May be repeated for credit.
- 408. **Seminar in Kant.** 1 unit. May be repeated for credit.
- 409. **American Philosophy.** Major American philosophers and movements. Reports and discussions. 1 unit. May be repeated for credit.
- 410. **Seminar in Nineteenth-Century Philosophy.** 1 unit. May be repeated for credit.
- 411. **Seminar in Ethical Theory.** 1 unit. May be repeated for credit.
- 412. **Seminar in Social Philosophy.** A seminar designed to study special problems in social philosophy; particular attention given to the contributions of the social sciences to social philosophy. See *Timetable* for current topics. 1 unit. May be repeated for credit.
- 413. **Logical Theory.** Logical syntax and semantics. Prerequisite: A course in logic or consent of instructor. 1 unit. May be repeated for credit.
- 415. **Seminar in Metaphysics.** Intensive study of a selected topic of major importance in the field of metaphysics. 1 unit. May be repeated for credit.
- 417. **Seminar in the Philosophy of Science.** Various problems arising from specific studies in philosophy pertaining to science and vice versa. To be offered with varying topics. 1 unit. May be repeated for credit.
- 420. **Seminar in Semantics.** Same as Communications 420. Intensive study of important contemporary contributions in the fields of semantics, analytic philosophy, and the philosophy of language. Prerequisite: Graduate standing in philosophy or equivalent. 1 unit. May be repeated for credit.
- 421. **Seminar in Contemporary Problems.** Intensive study of selected problems or topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. 1 unit. May be repeated for credit.
- 423. **Seminar in the Theory of Knowledge.** Selected topics and writings of major importance in the contemporary philosophy of knowledge. 1 unit. May be repeated for credit.
- 425. **Seminar in the Philosophy of Mind.** Selected topics from major writings in the philosophy of mind. 1 unit. May be repeated for credit.
- 483. **Individual Topics.** Individual study and oral and written reports on topics not covered in other courses. Topics and plan of study must be approved by the candidate's adviser and by the staff member who directs the work. ½ or 1 unit (summer session, ½ to 2 units).
- 499. **Thesis Research.** 0 to 4 units.

Religious Studies

Director of Program: Professor W. R. Schoedel

Office: 4016c Foreign Languages Building, Urbana

- 100. **Patterns in the Religions of Mankind.** Study of elementary religious forms, turning points in the history of religions, and problems of religion and society. 3 hours.
- 101. **The Bible as Literature.** Themes and literary genres in the Bible, emphasizing content important in Western culture. 3 hours. No more than 6 hours of credit may be received for Religious Studies 101, 201, and 202.
- 102. **Issues in Modern Religion.** Theological reflection on contemporary intellectual issues, including the dialogue between religion and aspects of social theory, psychology, history, and the natural sciences. 3 hours.
- 108. **Introduction to Biblical Hebrew.** Same as Hebrew 110. Stress on mastery of grammar, reading, writing, and simple prose composition; reading of simple Biblical prose. 4 hours.
- 109. **Introduction to Biblical Hebrew.** Same as Hebrew 111. Syntax and reading of simple classics' prose narrative. Prerequisite: Hebrew 110. 4 hours.
- 110. **World Religions.** Same as Philosophy 110. Survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity;

examination of basic texts and of philosophic theological elaborations of each religion. 3 hours.

111. **Elementary Koine Greek.** Same as Greek 111. Introduction to the fundamentals of Koine Greek, including reading from the New Testament. 4 hours.
112. **Elementary Koine Greek.** Same as Greek 112. Continuation of Religious Studies 111. Grammar and reading. Prerequisite: Religious Studies 111 or equivalent. 4 hours.
120. **Judaism: An Introduction.** Conceptions of the Holy Man and of Holiness within the Judaic tradition: the man of God, the worldly scribe, and the philosopher-king; holiness within and outside society; holiness through the heart, the mind, and the law; holiness through study; and the holy land, the holy tradition, and the new holy man. 3 hours.
121. **Christianity: An Introduction.** Typological approach to the major contemporary forms of Christianity: Eastern Orthodoxy, Catholicism, and Protestantism. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Intermediate Koine Greek.** Same as Greek 200. Reading of narrative and epistolary New Testament Greek. Prerequisite: Religious Studies 112 or equivalent. 4 hours.
201. **Ancient Israel: History and Literature.** The major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion; the function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours. No more than 6 hours of credit may be received for Religious Studies 101, 201, and 202.
202. **Earliest Christianity: The New Testament Period.** The ministry and teaching of Jesus within the historical context of ancient Judaism; the development of the Christian church from its beginnings as a sect within ancient Judaism to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours. No more than 6 hours of credit may be received for Religious Studies 101, 201, and 202.
204. **Prophecy in Israel and the Ancient Near East.** Prophetic performance in the ancient Near East; Israelite prophetic traditions; and general theories about prophecy. 3 hours.
208. **The Dead Sea Scrolls.** The literary works discovered in 1947 which were collected or written by a sect within Judaism near Wadi Qumran prior to the destruction of the Temple of Solomon in the first century of our era; their significance for understanding Judaism and Christianity. Prerequisite: Religious Studies 201 or 202. 3 hours.
210. **Biblical Prose.** Same as Hebrew 210. Reading and discussion of selections from the Books of Samuel with emphasis on grammar and exegesis; exercises in prose composition. Prerequisite: Religious Studies 108 and 109. 4 hours.
220. **Judaism in Modern Europe.** European Judaism from 1648 to 1917: Sabbatism, Hasidism, Zionism, birth of Jewish studies, birth of Reform Judaism, Neo-Orthodoxy, anti-Semitism, birth of modern Hebrew literature, and Secularism. 3 hours.
221. **American Judaism.** Forms of Judaism in America: Reform, Conservative, Reconstructionist, Orthodox, and Hasidic Judaism; the American rabbi; Zionism in American Jewish communal life; national Jewish organizations; the American synagogue; and the secular Jew. 3 hours.
229. **Sociology of Religion.** Same as Sociology 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; and adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
230. **Philosophy of Religion: Introduction.** Same as Philosophy 230. A critical study of theories about the nature of religion. 3 hours.
235. **Religion, Identity, and Meaning.** A psychohistorical approach to the study of religion. 3 hours.
240. **Judaism in Antiquity: From Ezra to Destruction of the Second Temple.** Judaism from 586 B.C. to A.D. 70: Nehemiah; the Samaritans; Jewish Apocalyptic; Ben Sira; Philo; the Pharisees; the Dead Sea Sect; the Zealots; the Sicarii; the Sadducees; and Judaism and Hellenism. 3 hours.

241. **Judaism in Antiquity: The Rabbinic Period.** Judaism from the destruction of the Second Temple until the Moslem conquest: the religion of the ordinary folk; the synagogue; the literary products of the period; the social forms of rabbinic Judaism; and the theology of the rabbis. 3 hours.
288. **Chinese Religion: An Introduction.** Introduction to the Chinese religious traditions from classical to modern times; emphasis on the ideals of Confucianism, Taoism, and Buddhism, and their historical interactions; for students interested in gaining sympathy with Eastern faith. 3 hours.
290. **Independent Study.** Special topics not treated in regularly scheduled courses; designed primarily for upperclassmen. Prerequisite: Evidence of adequate preparation for such study; consent of staff member supervising the work. 2 to 6 hours. May be repeated.
296. **Special Topics in the History of Judaism.** 3 hours. May be repeated for a maximum of 6 hours.
297. **Special Topics in Hinduism.** Elements of Hindu thought and practice; selected topics presented in historical order and in the context of Indian cultural history (including the present). 3 hours.
298. **Special Topics in Biblical Interpretation.** Detailed interpretation of selected books of the Bible. Prerequisite: Religious Studies 201 or 202. 3 hours.
301. **Introductory Coptic, I.** Same as Coptic 301. Introduction to the principles of Coptic grammar and to the reading of biblical and gnostic texts. A knowledge of classical or koine Greek, though useful, is not required. 3 hours or $\frac{3}{4}$ unit.
302. **Introductory Coptic, II.** Same as Coptic 302. Continuation of Coptic/Religious Studies 301; reading of gnostic and postbiblical texts. Prerequisite: Coptic/Religious Studies 301. 3 hours or $\frac{3}{4}$ unit.
304. **Medieval Civilization.** Same as History 304. The architectural, artistic, philosophical, political, and religious components of medieval culture, thought, and patterns of behavior; includes monasticism and society and the individual. Prerequisite: Sophomore standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
305. **The Age of the Renaissance.** Same as History 305. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **The Age of the Protestant and Catholic Reformation, 1500-1648.** Same as History 306. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
307. **Islam and the Near East, from Mohammed to 1258.** Same as History 307. The Near East under the Arab caliphs; the political, institutional, and intellectual development of Islam. Prerequisite: One year of college history. 3 hours, or $\frac{1}{2}$ or 1 unit.
311. **Hebrew Poetry.** Same as Hebrew 311. Translation and analysis of ancient Hebrew poetry, with emphasis on the development of Hebrew prosodic style and on textual criticism; research paper required for graduate credit. Prerequisite: Religious Studies 210 or equivalent. 4 hours or 1 unit.
328. **Sociology of Asian Religions.** Same as Sociology 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa; focus on the problems of social change and development; and concentration on the religious and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Religious Studies 229 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **Martin Luther.** Same as German 330. Special attention to Luther as an artist and to his importance for the development of German language and literature; attention also paid to the historical and intellectual trends of the fifteenth and sixteenth centuries as well as to the significance of Luther in modern psychological and sociological thought. Prerequisite: A reading knowledge of German or Latin, or consent of the instructor. 3 hours or $\frac{3}{4}$ unit.
340. **The Formation of Christian Thought.** Study of major developments in early Christian thought (first four centuries) through discussion of primary texts in translation. Prerequisite: Religious Studies 201 and 202, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
362. **Philosophy of Religion.** Same as Philosophy 324. A critical consideration of central arguments in the philosophy of religion, both in their traditional forms and in their mod-

- ern appearance: the justification of religious belief, the nature of God, religious experience, etc. Prerequisite: One course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
363. **Religion in Anthropological Perspective.** Same as Anthropology 363. Introduction to the study of magical and religious beliefs and practices in tribal and peasant societies; consideration of theories of the nature, origin, and function of magic and religion; myth, ritual, and symbolism; the relationship between great folk religious traditions; and socioreligious movements. Prerequisite: Anthropology 230 or 260, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
369. **Contemporary Religious Thought.** Same as Philosophy 363. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "Neoorthodox" Protestant thought. Prerequisite: One 5course in philosophy. 3 hours, or $\frac{3}{4}$ or 1 unit.
371. **The Gospels.** Same as Greek 371. Reading and analysis of the Greek Gospels following literary-critical, form-critical, and redaction-critical approaches. Prerequisite: Greek 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
381. **American Intellectual and Cultural History to 1865.** Same as History 371. The development of American thought to the mid-nineteenth century, emphasizing the interplay between imported ideas (religious, scientific, political, social, educational, and artistic) and the material and social environment in shaping American life. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **American Intellectual and Cultural History since 1859.** Same as History 372. The development of American thought and culture since 1859, emphasizing Darwinism and naturalist thought, religious and cultural events, the impact of science and technology, the American university, and recent cultural conflicts. Prerequisite: One year of college history or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
387. **History of Indian Buddhism.** The history of Buddhism in India from the Buddha to the Tantra, with emphasis on religious thought and practices. 3 hours, or $\frac{3}{4}$ or 1 unit.
388. **History and Thought of Chinese Buddhism.** Survey of the history of Chinese Buddhism since its introduction; analysis of Buddhological trends and styles; and the sociocultural milieu of Chinese Buddhism and its place in the total history of ideas and lifestyles. Prerequisite: Religious Studies 288 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
389. **Religion and Society in Japan.** Historical analysis of the interrelationship between religion and society in Japan from ancient to recent times; Shinto, Confucianism, Buddhism, and the unique expressions of various periods in art, architecture, and literature; includes primitivism, aesthetics, syncretism, reformation, and modernization. 3 hours, or $\frac{3}{4}$ or 1 unit.
490. **Independent Study.** Special topics not treated in regularly scheduled courses; for graduates. Prerequisite: Evidence of adequate preparation for such study and consent of staff member supervising the work. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units. May be repeated.

Slavic Languages and Literatures

(Including Czech, Polish, Russian, Serbo-Croatian, Slavic, and Ukrainian)

Head of Department: Professor M. Friedberg

Department Office: 3092 Foreign Languages Building, Urbana

CZECH

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
383. **The Structure of Modern Czech.** Analysis of the sound system and grammar of the contemporary Czech language with some reference to its historical development. Pre-

quisite: A knowledge of another Slavic language, preferably Russian, or consent of department. 3 hours or $\frac{3}{4}$ unit.

384. **Readings in Czech Literature.** Representative works of modern Czech literature and their historical and cultural background. Prerequisite: Czech 383 or consent of department. 3 hours or $\frac{3}{4}$ unit.

POLISH

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
345. **Polish Literature in Translation, I.** A critical survey, in translation, of Polish literature from the Middle Ages to the end of the nineteenth century illustrating the continuity of certain trends of thought and genre; special attention given to the works in their cultural context. 3 hours or 1 unit.
346. **Polish Literature in Translation, II.** A critical study, in translation, of modern Polish fiction, drama, poetry and essay, from young Poland to the New Wave ; their contribution to literary styles and genres in Poland and abroad; and special emphasis on Wyspianski, Witkiewicz, and Gombrowicz. 3 hours or 1 unit.
385. **The Structure of Modern Polish.** Analysis of the sound system and grammar of the contemporary Polish language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or $\frac{3}{4}$ unit.
386. **Readings in Polish Literature.** Analysis of selected literary texts. Prerequisite: Polish 385 or consent of department. 3 hours or $\frac{3}{4}$ unit.

RUSSIAN

Courses taught in Russian are 211, 212, 213, 214, 215, 216, 217, 301, 302, 303, 304, 313, and 314.

101. **First-Year Russian.** Oral-aural practice and elements of grammar, reading, and writing. For students who have no credit in Russian. 4 hours.
102. **First-Year Russian.** Continuation of Russian 101. Oral-aural practice and elements of grammar, reading, and writing. Prerequisite: Russian 101. 4 hours.
103. **Second-Year Russian.** Oral-aural practice, systematic functional grammar, reading, and writing. Prerequisite: Russian 102 or equivalent. 4 hours.
104. **Grammar Review and Conversation.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures, drills, and homework sheets; special attention paid to improving listening and speaking skills through class discussions and oral reports in Russian. Prerequisite: Russian 103. 4 hours.
105. **Grammar Review and Readings in Russian Culture.** Systematic review of the structure of Russian covered in Russian 101-103 through class lectures, drills, and homework sheets, as well as readings on various topics aimed at increasing the student's vocabulary and broadening cultural awareness of the Russian people. Prerequisite: Russian 103. 4 hours.
106. **Grammar Review and Readings in Russian Literature.** Identical to Russian 105, except that the readings are selected from Russian artistic literature. Prerequisite: Russian 103. 4 hours.
111. **Intensive First-Year Russian.** Oral-aural practice and elements of grammar, reading, and writing. Equivalent to Russian 101 and 102; for students who have no credit in Russian. 8 hours.
114. **Russian Civilization.** Survey of Russian civilization and culture with special emphasis on the people, national and social institutions, religion, and the arts (architecture,

- sculpture, painting, music, theatre, ballet). No knowledge of Russian required. 4 hours.
115. **Russian Masterpieces: The Modern Hero.** Readings in English translation selected from the nineteenth and twentieth centuries to illustrate the Russian contribution to man's perception of himself in literature during the modern era; Dostoevsky, Tolstoy, Chekhov, Solzhenitsyn, and others. No knowledge of Russian required. 3 hours.
116. **Russian Masterpieces: The Writer and Society.** Readings in English translation emphasizing the relationship between writer and state, the special bond between many Russian writers and the Russian land and people, and the persistent concern with the historical destiny of Russia and of mankind in general; Dostoevsky, Chekhov, Solzhenitsyn, Nabokov, and others. No knowledge of Russian required. 3 hours.
121. **Beginning Reading Course, I.** Russian basic grammar and vocabulary for recognition purposes; prepares students to read Russian for meaning and to translate into English. This course, taken in sequence with Russian 122, 123, and 124, meets the same requirements and can be taken in place of Russian 101, 102, 103, and 104. 4 hours.
122. **Beginning Reading Course, II.** Practice in reading and translating Russian texts of a general and specialized nature; emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 121. 4 hours.
123. **Intermediate Reading Course, I.** Practice in reading and translating Russian texts of a general and specialized nature; emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 122. 4 hours.
124. **Intermediate Reading Course, II.** Continuation of Russian 123. Prerequisite: Russian 123. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
211. **Oral Russian, I.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 104 or consent of instructor. 3 hours.
212. **Oral Russian, II.** Conversational practice for the development of oral facility with emphasis on contemporary usage. Prerequisite: Russian 211 or consent of instructor. 3 hours.
213. **Russian Composition, I.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 104 or consent of instructor. 3 hours.
214. **Russian Composition, II.** Training in writing Russian; translation from English and free composition. Prerequisite: Russian 213 or consent of instructor. 3 hours.
215. **Introduction to Russian Literature, I.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Two years of college Russian or consent of instructor. 3 hours.
216. **Introduction to Russian Literature, II.** Reading and close analysis of texts selected from Russian literature. Prerequisite: Russian 215 or consent of instructor. 3 hours.
217. **Introduction to Contemporary Russian Literature.** Reading and critical analysis of selected readings from post-thaw (1956) Russian literature. Prerequisite: Russian 215. 3 hours.
280. **Teachers Course.** An introduction to the problems of the teaching of Russian and a study of textbooks. Prerequisite: Three years of college Russian or equivalent. 4 hours.
290. **Readings in Russian.** Individual topics or projects chosen in consultation with a Slavic Department representative. Prerequisite: Russian 104, 105, 106, or 124, or equivalent proficiency. 1 to 4 hours. May be repeated for a maximum of 8 hours.
293. **Honors Senior Thesis.** Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours. May be repeated.
301. **Russian Prose Fiction, I.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature; emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 216 or equivalent. 3 hours or $\frac{3}{4}$ unit.
302. **Russian Prose Fiction, II.** An introduction to the short story as a genre in nineteenth- and twentieth-century Russian literature; emphasis on fundamental techniques of literary criticism. Prerequisite: Russian 301. 3 hours or $\frac{3}{4}$ unit.

303. **Advanced Reading and Conversation, I.** Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Three years of college-level Russian. 3 hours or $\frac{1}{2}$ unit.
304. **Advanced Reading and Conversation, II.** Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Russian 303 or equivalent. 3 hours or $\frac{1}{2}$ unit.
307. **Structure of Russian.** The morphology, syntax, and lexicon of modern Russian contrasted with English; attention to problems of teaching. Prerequisite: Russian 214 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
308. **Russian Phonetics and Pronunciation.** Study of the Russian sound system; training in the improvement of pronunciation and intonation. Prerequisite: Russian 212 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
313. **Advanced Composition and Usage, I.** Practice in advanced composition and study of advanced problems of grammatical structure; emphasis on morphological categories in Russian grammar. Prerequisite: Three years of college Russian including Russian 214, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
314. **Advanced Composition and Usage, II.** Further practice in advanced composition and study of advanced problems of grammatical structure; emphasis on syntax, usage, and style. Prerequisite: Russian 313 or consent of department. 3 hours or $\frac{3}{4}$ unit.
315. **Nineteenth-Century Literature in Translation.** A study of major Russian writers from Pushkin through Chekhov; no knowledge of Russian required. 3 hours or 1 unit.
317. **Twentieth-Century Literature in Translation.** A study of major Russian writers from 1900 to the present; no knowledge of Russian required. 3 hours or 1 unit.
321. **Russian Romanticism.** Representative works of the period 1810 to 1845, with emphasis on Pushkin, Lermontov, and Gogol; readings in English for nonconcentrators; classroom discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Dostoevsky and Tolstoy.** Representative works in their historical and cultural contexts; readings in English for nonconcentrators; classroom discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
323. **Russian Realism.** Representative works of the period 1845 to 1880, with emphasis on Turgenev, Dostoevsky, and Tolstoy; readings in English for nonconcentrators; classroom discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
324. **Russian Modernism.** Representative works of the period 1880 to 1917, with emphasis on Chekhov, Gorky, and Blok; readings for nonconcentrators and class discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
325. **Soviet Russian Literature.** Representative works of Russian literature since 1917, including Mayakovsky, Pasternak, Solzhenitsyn, and others; readings in English for nonconcentrators; classroom discussions in English. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
335. **Russian Drama.** Historical survey of Russian dramatists and their works, from the origins in folk and liturgical playlets through classicism, Gogol, Ostrovsky, Chekhov, and Stanslavsky to Meierhold and the Soviet drama. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
337. **Russian Poetry.** A study of significant Russian poets and their works from Zhukovsky through the twentieth century. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.
370. **Vladimir Nabokov.** Same as Comparative Literature 370 and English 370. The major contribution of Vladimir Nabokov to world literature; no knowledge of Russian required. Prerequisite: Junior standing or consent of instructor. 3 hours or 1 unit.
400. **Beginning Russian for Graduate Students.** Basic grammar and vocabulary; introduction to the reading of Russian texts in the sciences and the humanities. Designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. 4 hours.

401. **Readings in Russian for Graduate Students.** Reading and translation of general and individually specialized materials, to increase speed, accuracy, and vocabulary; designed for graduate students preparing to offer a reading knowledge of Russian for the Ph.D. Prerequisite: Russian 400 or equivalent. 4 hours.
406. **Russian Morphology.** Survey of the various parts of speech of modern standard literary Russian with special emphasis on the nominal and verbal systems. 1 unit.
407. **Russian Syntax.** Survey of historical and contemporary Russian syntax. Prerequisite: Consent of instructor or head of department. 1 unit.
408. **Russian Phonology.** Same as Linguistics 408. The sound pattern of Russian in its synchronic and diachronic aspects. Prerequisite: Consent of instructor. 1 unit.
410. **Old Russian Literature.** Reading and analysis of texts with historical and literary commentary. Prerequisite: Slavic 405. 1 unit.
412. **Literature of the Eighteenth Century.** Reading of texts; historical and literary background of the period. 1 unit.
414. **Pushkin.** The age of Pushkin; Pushkin's works in historical and comparative perspective; textual criticism, linguistic and structural analysis, intellectual interpretation, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
415. **Dostoevsky.** Same as Comparative Literature 415. Dostoevsky: historical background, textual analysis, structure, philosophy, artistic evaluation, and influence on French, English, American, and German literatures. 1 unit.
417. **History of the Russian Language.** Historical grammar, origin, and development of the literary language. Prerequisite: Slavic 405 or consent of instructor. 1 unit.
419. **Tolstoy.** Same as Comparative Literature 419. Tolstoy: historical background, textual analysis, structure, philosophy, aesthetic evaluation, and influence on French, English, American, and German literatures. 1 unit.
420. **Chekhov.** Same as Comparative Literature 420. Chekhov: historical background, textual criticism, structural analysis, philosophy, artistic evaluation, and interrelationship with English, French, German (and Scandinavian), and American literatures. 1 unit.
421. **Seminar in the Russian Novel.** Dostoevsky, Tolstoy, the nineteenth-century novel, and the twentieth-century novel. Prerequisite: Consent of instructor or head of department. 1 unit. May be repeated for a maximum of 3 units.
422. **Russian Literature in Exile.** Bunin, Merezhkovsky, Kuprin, Zaitsev, Remizov, Teffi, Aldanov, Shmelev, Z. Hippus, V. Ivanov, Khodasevich, Tsvetaeva, Varshavsky, Odoevtseva, G. Ivanov, and Adamovich: prose writers, poets, and critics. 1 unit.
423. **Seminar in Russian Poetry.** Pushkin, narrative verse, lyric verse, and symbolism. Prerequisite: Russian 337 or consent of department. 1 unit. May be repeated for a maximum of 3 units.
424. **Gogol.** Historical background, textual criticism, structural analysis, philosophy and ideology, and aesthetic evaluation. Prerequisite: Consent of instructor or head of department. 1 unit.
425. **Seminar in Russian Drama.** Intensive analysis and discussion of specific genres, periods, and dramatists in the light of dramatic theories; subject varies each year. Prerequisite: Russian 335 or consent of department. 1 unit. May be repeated for a maximum of 3 units.
463. **College Teaching of Foreign Languages.** Same as English as a Second Language, French, German, and Spanish 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as English as a Second Language, French, German, and Spanish 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Consent of instructor. 1 unit.

SERBO-CROATIAN

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
392. **Structure of Modern Serbo-Croatian.** Analysis of the sound system and grammar of the contemporary Serbo-Croatian language. Prerequisite: Knowledge of another Slavic language or consent of department. 3 hours or $\frac{3}{4}$ unit.
393. **Reading in Serbo-Croatian Literature.** Reading, analysis, and discussion of selected excerpts from Serbo-Croatian literature, scientific prose, and current press. Prerequisite: Serbo-Croatian 392 or consent of department. 3 hours or $\frac{3}{4}$ unit.

SLAVIC

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
319. **Russian and East European Cinema.** Same as Communications and Speech Communication 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian. No reading knowledge of Russian is required, except for Department of Slavic Languages and Literatures majors. 3 hours or $\frac{3}{4}$ unit.
380. **Introduction to Slavic Linguistics.** Same as Linguistics 380. The development of Common Slavic from Indo-European and its relationship to contemporary Slavic languages. Prerequisite: Reading knowledge of at least one Slavic language. 3 hours or $\frac{3}{4}$ unit.
381. **Introduction to Study and Research in Slavic Languages and Literatures.** Introduction to methods and resources for study and research in Slavic languages, Russian literature, and Russian language teaching. 2 hours or $\frac{1}{2}$ unit.
382. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, French, German, Humanities, and Spanish 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
387. **Introduction to Myth and Folklore.** Same as Comparative Literature, English, German and Speech Communication 387. Prerequisite: One year of college literature, or consent of instructor. 3 hours or 1 unit.
405. **Old Church Slavonic.** Analysis of grammar and reading of texts. Prerequisite: Slavic 380 or consent of instructor. 1 unit.
431. **Comparative Slavic Literature.** Same as Comparative Literature 431. Survey of Slavic literatures, especially Czech, Polish, and Yugoslav, and their connection with Russian and Western traditions. 1 unit.
460. **Comparative Slavic Linguistics.** A comparative analysis of the structure of contemporary Slavic languages in the light of their common Slavic origin. Prerequisite: Slavic 380. 1 unit.
485. **The Structure of West Slavic Languages.** Linguistic survey of the West Slavic languages: Polish, Czech, Slovak, Lusatian, and Kashubian; focus on one of the major West Slavic languages (Czech or Polish) as compared with the other West Slavic languages and languages of the East and South groups. Prerequisite: Slavic 380. 1 unit.
491. **Individual Topics.** Prerequisite: Graduate standing with a major or minor in Russian. $\frac{1}{4}$ to 2 units.
492. **The Structure of South Slavic Languages.** Linguistic survey of the South Slavic languages: Serbo-Croatian, Bulgarian, Slovenian, and Macedonian; focus on Serbo-Croatian as compared with the other South Slavic languages and the languages of the East and West Slavic groups. Prerequisite: Slavic 380. 1 unit.
499. **Thesis Research.** 0 to 4 units.

UKRAINIAN

118. **Ukrainian Literature in Translation.** Critical survey of major works in Ukrainian literature from the beginnings to the modern period in light of their historical and cultural background; lectures and readings in English. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
396. **The Structure of Ukrainian.** Ukrainian phonology, morphology, and syntax, presented against Russian as a background and basis for comparison of these two East Slavic languages. Prerequisite: Russian 104 or equivalent. 3 hours or $\frac{3}{4}$ unit.
398. **Ukrainian Literature in Translation.** Critical survey of major works in Ukrainian literature from the beginnings to the modern period in light of their historical and cultural background; lectures and readings in English. 3 hours or $\frac{3}{4}$ unit.

Spanish, Italian, and Portuguese

(Including Catalan and Romance Linguistics)

Head of Department: Professor A. M. Pasquariello

Department Office: 4080 Foreign Languages Building, Urbana

CATALAN

301. **Studies in Catalan Language.** An introductory study of the Catalan language. Prerequisite: Eight hours of Latin or any Romance language. 2 hours or $\frac{1}{2}$ unit.
302. **Studies in Catalan Literature.** An introductory study to major works of Catalan literature. Prerequisite: Catalan 301. 2 hours or $\frac{1}{2}$ unit.

ITALIAN

101. **Elementary Italian.** For students who have no credit in Italian. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. 4 hours.
102. **Elementary Italian.** Continuation of Italian 101. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. Prerequisite: Italian 101 or one year of high school Italian. 4 hours.
103. **Intermediate Italian.** Rapid reading, review of grammar, composition, and conversation. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. Prerequisite: Italian 102 or two years of high school Italian. 4 hours.
104. **Intermediate Italian.** Continuation of Italian 103. Prerequisite: Italian 103 or three years of high school Italian. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
209. **Italian Syntax and Phonetics.** Italian composition and conversation; syntax and phonetics. Prerequisite: Italian 104 or consent of instructor. 3 hours.
211. **Composition and Conversation, I.** Training in oral-aural skill and in writing; practice in the language laboratory required. Prerequisite: Italian 209 or consent of instructor. 3 hours.
212. **Composition and Conversation, II.** Continuation of Italian 211. Prerequisite: Italian 211 or consent of instructor. 3 hours.
221. **Introduction to Italian Literature, I.** Introduction to representative works and movements of Italian literature since the Renaissance. Prerequisite: Italian 104 or consent of instructor. 3 hours.

222. **Introduction to Italian Literature, II.** Introduction to representative works and movements of Italian literature in the Middle Ages and the Renaissance. Prerequisite: Italian 221 or consent of instructor. 3 hours.
290. **Readings in Italian.** Readings chosen in consultation with an adviser. Prerequisite: Italian 104 or consent of instructor. 2 to 4 hours. May be repeated for credit.
293. **Honors Senior Thesis.** For candidates for honors in Italian. 2 hours. May be repeated.
309. **Petrarch and Boccaccio: Literature of the Italian Middle Ages.** Studies in Petrarch and Boccaccio; nonconcentrators in Italian may read the works in translation; lectures are in English. Prerequisite: Fulfillment of campus rhetoric requirement. 3 hours or $\frac{3}{4}$ unit.
311. **Dante: *La Divina Commedia*, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Dante: *La Divina Commedia*, II.** Prerequisite: Italian 311 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
313. ***The Divine Comedy*.** Same as Comparative Literature 313. An interpretation of Dante's *Divine Comedy* with special attention to its position in the medieval world; a knowledge of Italian not required. Prerequisite: Junior standing. 2 hours or $\frac{1}{2}$ unit.
321. **Modern Italian Literature, I.** Prerequisite: Italian 222 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
322. **Modern Italian Literature, II.** Prerequisite: Italian 321 or 222, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
331. **Italian Culture.** Introduction to factors that have shaped present-day Italy; basic concepts contributing to understanding its present social and cultural development. Prerequisite: Italian 211 or 221, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
333. **Masterpieces of Italian Renaissance Literature.** A reading of masterpieces of the 1400 and 1500s and a study of their predecessors and influence; nonconcentrators in Italian may read the works in translation; lectures are in English. Content rotates. Prerequisite: Fulfillment of campus rhetoric requirement. 3 hours or $\frac{3}{4}$ unit. May be repeated to a maximum of 6 hours or 1 $\frac{1}{2}$ units with consent of instructor.
362. **Introduction to Romance Linguistics.** Same as French, Linguistics, Portuguese, Romance Linguistics, and Spanish 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
400. **Beginning Course for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 hours. No graduate credit.
401. **Readings in Italian for Graduate Students.** An intensive language course designed to teach reading skills to graduate students; a continuation of Italian 400. Prerequisite: Italian 400 or consent of instructor. 4 hours. No graduate credit.
411. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit.
412. **Italian Literature in the Middle Ages: Petrarch and Boccaccio.** 1 unit.
415. **Italian Literature of the Renaissance.** 1 unit.
416. **Italian Literature of the Renaissance.** 1 unit.
422. **Manzoni e il romanticismo europeo.** Manzoni and the romantic movement. Prerequisite: Italian 321 and 322, or equivalent. 1 unit.
447. **Introduction to Romance Stylistics.** Same as French, Portuguese and Spanish 447. A brief history of the schools and theories of Romance stylistics, especially the French-Swiss *stylistique* (Bally, Marouzeau, and Cressot) and the German-Spanish *Stilforschungen* (Spitzer, Hatzfeld, Kayser, A. Alonso, and D. Alonso); includes a study of representative works and assigned topics for analysis. Prerequisite: Graduate standing in one of the Romance languages; reading knowledge of French and Spanish or consent of instructor. 1 unit.
451. **History of the Italian Language.** 1 unit.
452. **Seminar in Italian Linguistics.** 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Linguistics, Portuguese, Romance

Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Italian 362 and consent of instructor. 1 unit.

491. **Special Topics in Italian.** $\frac{1}{2}$ or 1 unit.

499. **Thesis Research.** 0 to 4 units.

PORTUGUESE

101. **Elementary Portuguese, I.** For students who have no credit in Portuguese. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. 4 hours.

102. **Elementary Portuguese, II.** Continuation of Portuguese 101. Prerequisite: Portuguese 101. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. 4 hours.

103. **Intermediate Portuguese.** Rapid reading, review of grammar, composition, and conversation. Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 4 hours.

104. **Intermediate Portuguese.** Continuation of Portuguese 103. Prerequisite: Portuguese 103 or three years of high school Portuguese. 4 hours.

111. **Elementary Portuguese.** For students who have no credit in Portuguese. All students in this course are required to register for two hours per week in the language laboratory. 8 hours.

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.

209. **Portuguese Syntax and Phonetics.** An introduction to the advanced study of the language with basic elements of applied phonetics and syntax. Must be taken with Portuguese 211. Prerequisite: Portuguese 104 or consent of instructor. 3 hours.

211. **Composition and Conversation, I.** Prerequisite: Portuguese 104 or consent of instructor. 3 hours.

212. **Composition and Conversation, II.** Prerequisite: Portuguese 211 or consent of instructor. 3 hours.

221. **Introduction to Portuguese Literature.** Survey of the most representative works from the Middle Ages to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 104 or consent of instructor upon demonstrating competency in reading Portuguese. 3 hours.

222. **Introduction to Brazilian Literature.** Survey of the most representative works from the sixteenth century to the present with emphasis on the evolution of the country's literary history. Prerequisite: Portuguese 221 or consent of instructor. 3 hours.

290. **Readings in Portuguese.** Readings chosen in consultation with a departmental adviser. Prerequisite: Portuguese 104 or consent of instructor. 2 to 4 hours.

301. **Brazilian Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

302. **Portuguese Literature.** Prerequisite: Portuguese 222 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

303. **Luso-Brazilian Culture.** Affords a broad understanding of the origins of Luso-Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

304. **Brazilian Culture.** Affords a broad understanding of contemporary Brazilian civilization and culture. Prerequisite: Portuguese 211 or 221, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

305. **Reading Portuguese.** An accelerated course based on Portuguese-Spanish contrastive analysis; designed to enable students who can already read Spanish to read nonliterary and literary works in Portuguese and to develop a modicum of listening comprehension. Prerequisite: Spanish 104 or equivalent, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, Romance Linguistics, and Spanish 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
405. **Structure of Brazilian Portuguese: Phonology.** Phonetics and phonemics of modern Brazilian Portuguese. Prerequisite: Portuguese 104 or consent of instructor. 1 unit.
406. **Structure of Brazilian Portuguese: Morphology and Syntax.** Morphemics and syntax of modern Brazilian Portuguese. Prerequisite: Portuguese 405 or consent of instructor. 1 unit.
407. **Studies in Brazilian Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Brazilian literature; subject matter varies each time the course is offered. Prerequisite: Portuguese 301 or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
408. **Studies in Portuguese Literature.** Advanced study of literary movements, major writers, and intellectual and cultural ideas in Portuguese literature; subject matter varies each time the course is offered. Prerequisite: Portuguese 302 or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
447. **Introduction to Romance Stylistics.** Same as French, Italian and Spanish 447. A brief history of the schools and theories of Romance stylistics, especially the French-Swiss *stylistique* (Bally, Marouzeau, and Cressot) and the German-Spanish *Stilforschungen* (Spitzer, Hatzfeld, Kayser, A. Alonso, and D. Alonso); includes a study of representative works and assigned topics for analysis. Prerequisite: Graduate standing in one of the Romance languages; reading knowledge of French and Spanish or consent of instructor. 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Romance Linguistics, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Portuguese 362 and consent of instructor. 1 unit.
491. **Special Topics in Portuguese.** $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

ROMANCE LINGUISTICS

362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Spanish 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Spanish 462. Selected topics in comparative Romance linguistics. Prerequisite: Romance Linguistics 362 and consent of instructor. 1 unit.

SPANISH

101. **Elementary Spanish.** For students who have no credit in Spanish. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. 4 hours.
102. **Elementary Spanish.** Continuation of Spanish 101. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. Prerequisite: Spanish 101 at the University of Illinois at Urbana-Champaign. All other second semester Spanish students should enroll in Spanish 122. 4 hours.
103. **Intermediate Spanish, I.** Rapid reading review of grammar, composition, conversation, and reading for students who may be interested in pursuing Spanish in advanced courses. There will be a series of supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. With Spanish

- 104, 124, 134, or 114, this course fulfills the foreign language requirement. Prerequisite: Spanish 102 or 105 or 122, or assignment by placement test. 4 hours.
- 104. Intermediate Spanish, II.** Continuation of Spanish 103 for students who may be interested in pursuing Spanish in more advanced courses. Completion of this course fulfills the college foreign language requirement. There is a series of supplementary lectures and audio-visual presentations on Hispanic topics. Prerequisite: Spanish 103 or 123, or assignment by placement test. 4 hours.
- 105. Intensive Beginning Spanish.** Equivalent to Spanish 101 and 102, for students with no prior Spanish credit who wish to learn at a rapid rate; speaking, reading, writing, and aural comprehension. All students in this course are required to attend four twenty-minute laboratory sessions per week in the language laboratory. 8 hours.
- 107. Intensive Intermediate Spanish.** For students who wish to complete Spanish 103 and 104 at a rapid rate. Grammar review, readings, and cultural history; conducted in Spanish. There is a series of supplementary lectures and audio-visual presentations on Hispanic topics. Prerequisite: Spanish 102 or 122, or equivalent placement score. 8 hours.
- 114. Conversational Spanish.** Conversation in Spanish on topics of current interest; brief grammar review as necessary to improve oral skills; and some reading required in preparation for classroom discussions. Fulfills the foreign language requirement but does not serve as prerequisite for advanced courses in Spanish without departmental approval. There is a series of supplementary lectures and audio-visual presentations on Hispanic topics, with background readings in Spanish and English. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
- 122. Elementary Spanish.** Second-semester Spanish course for all students who did not take Spanish 101 at this University. All students in this course are required to attend two twenty-minute laboratory sessions per week in the language laboratory. Prerequisite: Spanish 101 elsewhere or assignment by placement exam. 4 hours.
- 123. Reading and Speaking Spanish, I.** Readings in Spanish of literary and cultural texts with discussion in Spanish; some grammar essential to development of reading and oral skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. With Spanish 104, 124, 134, or 114, this course fulfills the foreign language requirement. Students planning to take advanced courses in Spanish should enroll in Spanish 103. Prerequisite: Spanish 102, 122, or 105, or equivalent placement score. 4 hours.
- 124. Reading and Speaking Spanish, II.** Continuation of Spanish 123; readings in Spanish literary and cultural texts with discussion in Spanish; includes some grammar essential to the development of reading and oral skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. Fulfills the foreign language requirement, but does not serve as a prerequisite for more advanced courses in Spanish without departmental approval. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
- 134. Reading Spanish.** Readings in Spanish texts with discussion in English; some grammar essential to development of reading skills; and supplementary lectures and audio-visual presentations on Hispanic topics with background readings in Spanish and English. Fulfills the foreign language requirement, but does not serve as a prerequisite for advanced courses in Spanish without departmental approval. Readings will focus on Latin American politics, Spanish institutions, twentieth century Hispanic literature, twentieth century concerns in Hispanic societies, etc. Prerequisite: Spanish 103 or 123, or equivalent placement score. 4 hours.
- 199. Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
- 200. Literary Analysis.** Study of literary styles and techniques of analysis as applied to major genres of Hispanic literature. Prerequisite: Spanish 104 or consent of instructor. 2 hours.
- 209. Spanish Language.** A practical course on Spanish phonology and morphology; inten-

- sive drill in Spanish sound and verb systems, and analysis of sentence structure. Prerequisite: Spanish 104 or consent of instructor. 3 hours.
211. **Oral Spanish.** Practice in speaking Spanish; to be taken concurrently with or subsequent to Spanish 209. Meets four hours per week. Prerequisite: Spanish 104. 2 hours.
215. **Intensive Spoken Spanish.** Intensive oral contact with Spanish; meets five hours per week. Prerequisite: Spanish 211 or consent of instructor. 2 hours. May be repeated once for credit.
217. **Spanish Composition, I.** Basic composition course; problems of written Spanish and principles of Spanish rhetorical patterns; introduction to Spanish metrics and poetic forms; and weekly written exercises. Prerequisite: Spanish 209 and junior standing, or consent of instructor. 3 hours.
225. **Spanish for Near Native Speakers.** Review of Spanish pronunciation, orthography, syntax, and vocabulary for students of Hispanic background who have little or no formal training in the Spanish language. Prerequisite: Consent of advisor and instructor. 3 hours.
232. **Culture of Spain.** Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 2 hours.
233. **Culture of Spanish America.** Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 2 hours.
240. **Spanish Literature: Medieval and Golden Age.** Introduction to major works and movements of the Middle Ages and the Golden Age. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.
241. **Spanish Literature: Eighteenth Century to the Present.** Study of representative masterpieces within the context of major periods and trends. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.
242. **Spanish-American Literature.** Introduction to major literary movements and works in Spanish America. Prerequisite: Spanish 200, 209, and 211, or consent of instructor. 3 hours.
250. **The Worlds of Jorge Luis Borges and Julio Cortazar.** The major works of two of the most important contemporary writers of Spanish-American fiction will be read in translation and analyzed in English. 3 hours.
255. **The World of Cervantes.** An analysis entirely in English of Cervantes' masterpiece *Don Quixote* and of his *Exemplary Stories*; designed to convey an appreciation of the cultural significance of the baroque period as the end of the Renaissance and the beginning of the modern epoch; no knowledge of Spanish required. 3 hours.
260. **Spanish for Industry and Commerce.** Introduction to vocabulary of Hispanic commerce; composition of business letters and similar texts. Prerequisite: Spanish 104 or consent of instructor. 3 hours.
280. **Teachers Course.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or 211, or consent of instructor. 4 hours.
293. **Honors Senior Thesis.** For candidates for honors in Spanish. 2 hours. May be repeated.
298. **Senior Seminar.** Intensive study of Hispanic linguistics or literature. Prerequisite: Senior standing. 2 hours. May be repeated for credit with adviser's consent.
305. **Romanticism and Realism in Nineteenth-Century Spanish Literature.** A study of representative authors and genres of the nineteenth century; particular emphasis on the romantic drama and the realistic novel. Prerequisite: Spanish 241 or equivalent. 3 hours or $\frac{3}{4}$ unit.
306. **The Generation of 1898.** A study of representative works of Baroja, Azorin, Unamuno, Macztu, Valle Inclan, Benavente, A. Machado, and others. Prerequisite: Spanish 241 or equivalent. 3 hours or $\frac{3}{4}$ unit.
307. **Spanish-American Literature to 1888.** Study of the development of Spanish-American literature from the sixteenth century through the end of the romantic period. Prerequisite: Spanish 242 or equivalent. 3 hours or $\frac{1}{2}$ unit.
308. **Spanish-American Modernismo.** A study of Spanish-American literature from 1888 to the end of World War I. Prerequisite: Spanish 242 or equivalent. 3 hours or $\frac{3}{4}$ unit.

309. **Introduction to Medieval Spanish Literature.** Historical and cultural background for the Middle Ages; selected readings in medieval literature from the *Jarchas* to *Corbacho*. Prerequisite: Spanish 240 or equivalent. 3 hours or $\frac{3}{4}$ unit.
310. **Contemporary Spanish-American Literature.** A study of Spanish-American literature from World War I to the present. Prerequisite: Spanish 242 or equivalent. 3 hours or $\frac{3}{4}$ unit.
311. *Don Quixote* and the Prose of the Golden Age. Introduction to *Don Quixote*, to its relationship to other selected masterpieces of the Golden Age, and to the main currents and forms of Golden Age prose. Prerequisite: Spanish 240 or equivalent. 3 hours or $\frac{3}{4}$ unit.
314. **Spanish Drama and Poetry of the Golden Age.** Prerequisite: Spanish 240 or equivalent. 3 hours or $\frac{3}{4}$ unit.
351. **Phonetics.** Prerequisite: Spanish 209 or equivalent. 3 hours or $\frac{1}{2}$ unit.
352. **Syntax.** Required for teacher-training majors in Spanish. Prerequisite: Spanish 209 or equivalent. 3 hours or $\frac{1}{2}$ unit.
353. **Spanish Structure.** Same as Linguistics 353. Comprehensive analysis of Spanish phonology and syntax based on present-day linguistic theory. Prerequisite: Linguistics 300; Spanish 351; Spanish 352. 3 hours or $\frac{1}{2}$ unit.
362. **Introduction to Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 362. Comparative and historical analysis of the Romance languages. Prerequisite: Four semesters of a Romance language or Latin, or equivalent. 3 hours or $\frac{3}{4}$ unit.
371. **Spanish for Teachers.** A consideration of language problems suggested by teaching experience. Prerequisite: Spanish 209 or equivalent. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.
382. **Language Laboratory Techniques.** Same as Classical Civilization, English as a Second Language, French, German, Humanities, and Slavic 382, and Linguistics 386. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of a modern foreign language at the college level, or equivalent. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
399. **Study Abroad.** Lectures, seminars, and practical work in Spanish language, literature, and civilization, in Spain. Prerequisite: Spanish 211 or equivalent; Spanish 200 or equivalent; 3.5 overall average; 4.0 average in Spanish courses. 0 to 15 hours per semester, up to 30 hours, all of which must be earned in two semesters; or 0 to 8 units, all of which must be earned in two semesters (may be repeated to a maximum of 8 units).
400. **Beginning Spanish for Graduate Students.** Basic grammar and vocabulary; reading practice. 4 hours. No graduate credit.
401. **Readings in Spanish for Graduate Students.** Continuation of Spanish 400; special readings in the critical literature of several disciplines. Prerequisite: Spanish 400 or consent of instructor. 4 hours. No graduate credit.
405. **Spanish Bibliography.** An introduction to bibliographical method and to the principal bibliographical resources for the study of Spanish and Latin American literature. $\frac{1}{2}$ unit.
411. **Medieval Literature to 1300.** Survey of medieval Spanish literature to 1300; special attention to relationship with other medieval literatures of western Europe. Prerequisite: Spanish 309. 1 unit.
412. **Medieval Literature, 1300-1500.** Survey of medieval Spanish literature from 1300 to 1500; special attention to relationship with other medieval literatures of western Europe. Prerequisite: Spanish 309. 1 unit.
415. **Renaissance and Baroque Prose in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
417. **Renaissance and Baroque Drama in Spain.** Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
418. **Seminar in Renaissance and Baroque Literature.** 1 unit. May be repeated for credit.

419. Cervantes. *Don Quixote* and representative minor works. Prerequisite: Spanish 311 and 314, or equivalent. 1 unit.
421. Modern Spanish Novel and Essay. 1 unit.
422. Contemporary Spanish Novel and Essay. 1 unit.
423. Modern Spanish Drama. Dramatic literature of Spain in the eighteenth and nineteenth centuries. 1 unit.
424. Contemporary Spanish Drama. Dramatic literature of Spain in the twentieth century. 1 unit.
425. Renaissance and Baroque Poetry in Spain. 1 unit.
426. Spanish Poetry of the Nineteenth and Twentieth Centuries. 1 unit.
427. Studies in Twentieth-Century Spanish Literature. Advanced study of major literary movements, genres, or authors in twentieth-century Spanish literature; subject matter varies. Prerequisite: Spanish 306 or any survey of contemporary Spanish literature, or equivalent. 1 unit. May be repeated for a maximum of 2 units.
428. Studies in Nineteenth-Century Spanish Literature. Advanced study of major literary movements, genres, or authors in nineteenth-century Spanish literature; subject matter varies. Prerequisite: Spanish 305 or equivalent. 1 unit. May be repeated for a maximum of 2 units.
429. Studies in Golden Age. Advanced study of major literary movements, genres, or authors in sixteenth- and seventeenth-century Spanish literature; subject matter varies. Prerequisite: Spanish 311 or 314, or any survey of Spanish literature. 1 unit. May be repeated for a maximum of 2 units.
430. Studies in Twentieth-Century Spanish-American Literature. Advanced study of major literary movements, genres, or authors in twentieth-century Spanish-American literature; subject matter varies. Prerequisite: Spanish 307, 308, or 310, or equivalent. 1 unit. May be repeated for a maximum of 2 units.
431. Spanish-American Poetry to 1920. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
432. Contemporary Spanish-American Poetry. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
433. Spanish-American Novel to 1945. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
434. Spanish-American Novel Since 1945. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
435. Seminar in Spanish-American Poetry. Prerequisite: Spanish 431 or 432. 1 unit.
436. Seminar in Spanish-American Novel. Same as Comparative Literature 462. Special problems in methodology and research; includes other prose fiction. Prerequisite: Spanish 433 or 434. 1 unit.
437. Spanish-American Drama. Prerequisite: Spanish 307, 308, or 310. 1 unit.
438. Spanish-American Essay. Prerequisite: Spanish 307, 308, or 310. 1 unit.
439. The Spanish-American Short Story. Intensive and analytical study of the principal *cuentistas* of Spanish America. Prerequisite: Spanish 307, 308, and 310, or equivalent. 1 unit.
442. Seminar in Modern Spanish Literature. Study of problems in the works of a major writer or group of writers of the eighteenth or nineteenth centuries. Prerequisite: Spanish 305; Spanish 421 or 423, or equivalent. 1 unit.
444. Seminar in Spanish Realism and Naturalism. Research work in nineteenth-century literary theory and practice in novel and drama. Prerequisite: Spanish 421 and 442. 1 unit.
445. Seminar in Twentieth-Century Spanish Literature. Investigation of literary problems presented by the Spanish novel, drama, and/or essay since 1900. Prerequisite: Spanish 421, 422, 423, or 424, or equivalent. 1 unit.
447. Introduction to Romance Stylistics. Same as Italian, Portuguese and French 447. A brief history of the schools and theories of Romance stylistics, especially the French-Swiss *stylistique* (Bally, Marouzeau, and Cressot) and the German-Spanish *Stilforschungen*

- (Spitzer, Hatzfeld, Kayser, A. Alonso, and D. Alonso); includes a study of representative works and assigned topics for analysis. Prerequisite: Graduate standing in one of the Romance languages; reading knowledge of French and Spanish or consent of instructor. 1 unit.
451. **Seminar in Spanish Descriptive Linguistics.** Selected topics of Spanish phonology and syntax in the light of present-day linguistic theory. Prerequisite: Consent of instructor. 1 unit.
452. **Seminar in Spanish Historical Linguistics.** Selected topics on the development of Spanish and its dialects in the light of present-day historical methods. Prerequisite: Consent of instructor. 1 unit.
453. **History of the Spanish Language.** 1 unit.
454. **Old Spanish.** 1 unit.
455. **Historical Spanish Grammar.** Internal history of the Spanish language; phonological, morphological, and syntactic evolution from Latin to modern Spanish. Prerequisite: Two semesters of college Latin or equivalent. 1 unit.
462. **Seminar in Romance Linguistics.** Same as French, Italian, Linguistics, Portuguese, and Romance Linguistics 462. Selected topics in comparative Romance linguistics. Prerequisite: Spanish 362 and consent of instructor. 1 unit.
463. **College Teaching of Foreign Languages.** Same as English as a Second Language, French, German, and Russian 463. Rationale for curricular objectives for college courses in foreign languages; the teaching and testing of pronunciation, listening comprehension, speaking, reading, writing, cultural understanding, and literary appreciation; the use of technology; and recent experimentation. 1 unit.
471. **Applied Linguistics and Teaching College Spanish.** Study of the structure of Spanish with special emphasis on the teaching situation in elementary Spanish courses. 1 unit.
481. **Seminar in Linguistic and Psychological Foundations of Language Teaching.** Same as English as a Second Language, French, German, and Russian 481. Language teaching problems considered in the light of theoretical and experimental work in language acquisition, verbal learning and memory, motivation, speech perception, reading, error analysis, and language as an aspect of culture and societal relations. Prerequisite: Consent of instructor. 1 unit.
491. **Special Topics in Spanish.** ½ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

Speech Communication

Head of Department: Professor R. E. Nebergall

Department Office: 244 Lincoln Hall, Urbana

101. **Principles of Effective Speaking.** Preparation and presentation of short informative and persuasive speeches; emphasis on the selection and organization of material, methods of securing interest and attention, and the elements of delivery. 3 hours.
102. **Introduction to Speech Communication.** Survey of the questions probed, the methods employed, and the current status of knowledge in the speech communication discipline; provides opportunities to understand the range of concerns and to explore specific areas of interest of the field. 4 hours.
105. **Voice and Articulation.** Same as Speech and Hearing Science 105. Basic factors of voice and speech sound production; analysis of faults that result in minor speech deviations or inadequacies; and individual analysis and guided practice toward improvement of speech habits. 2 hours.
107. **Parliamentary Procedure.** Principles and practice of parliamentary procedure. 2 hours.
111. **Verbal Communication.** Principles and practice in communication; stress on fundamentals of exposition in writing and speaking. The University rhetoric requirement is

fulfilled by this course in conjunction with Speech Communication 112. Credit is not given for both Speech Communication 111 and 101. 3 hours.

112. **Verbal Communication.** Theory and practice of communication; stress on deliberation and fundamentals of persuasion through speaking and writing. The University rhetoric requirement is fulfilled by this course. Credit is not granted for both Speech Communication 112 and 101. Prerequisite: Speech Communication 111. 3 hours.
113. **Group Discussion and Conference Leadership.** Study of leadership, group process, and interpersonal relations in the small group, conference, and the public forum; emphasis on practice in leading and participation in various types of public discussion and conference, with materials drawn from current public questions. Prerequisite: Sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours.
120. **Advanced Oral Communication.** Advanced principles of speech preparation and presentation; special problems and types of speeches; and considerable practice in composition and delivery of speeches. Prerequisite: Speech Communication 101 or equivalent. 3 hours.
123. **Public Discussion and Debate.** Study of and participation in public discussion and debate with emphasis on thorough preparation and research, principles of analysis, reasoning, evidence, and persuasive presentation of well-founded convictions; previous debate experience not required. 2 hours. May be repeated for a maximum of 4 hours.
141. **Oral Interpretation.** Oral reading for understanding, appreciation, and communication. 3 hours.
142. **Group Oral Interpretation of Literature.** Study of modern modes of group presentation of literature; emphasis on practice in script preparation, directing, and performance in chamber theatre and readers' theatre. Prerequisite: Speech Communication 141 or consent of instructor. 2 hours.
157. **Elements of Stagecraft.** Same as Theatre 120. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
161. **Fundamentals of Acting.** Same as Theatre 170. Study of the methods of acting, with emphasis on basic techniques; the role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretation by means of voice and action. 3 hours.
177. **The Arts of Public Discourse.** The nature and forms of practical and artistic public speech, including adaptations for the mass audience. 4 hours.
178. **The Arts of the Theatre and Interpretative Speech.** The nature and forms of performing speech arts of theatre, interpretation, and film, including adaptations for the mass audience. 4 hours.
198. **Freshman Seminar.** Survey of the role of the screen media in contemporary American culture; discussions, reports, and papers on topics of individual concern. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
203. **Dramatics for Teachers.** Survey of methods and procedures of play production in the secondary school. 3 hours.
204. **Speech for Teachers.** A course in teaching methods designed for prospective teachers who are non-speech communication majors; discussion of methods and materials available for teaching speech and directing extracurricular speech activities. 3 hours.
207. **The Art of the Screen: Humor.** Study of selected comedies and other specimens of film and television humor in relation to theories of humor. Prerequisite: Consent of instructor. 3 hours.
210. **The Rhetorical Tradition.** Survey of major trends in the development of rhetorical theory from Homer to the present. 3 hours.
211. **Business and Professional Speaking.** Study, preparation, and presentation of the chief

- types of business speeches; special attention to conferences, sales talks, interviews, and job applications. Prerequisite: Speech Communication 101. 2 hours.
213. **Persuasion and the Arts.** Introduction to the study of narrative films, theatre, fiction, and poetry as vehicles of indirect and overt persuasion. 3 hours.
221. **Persuasion.** Study of the processes of motivation as applied to speeches intended to influence group opinion and action; practice in the preparation and delivery of short persuasive speeches. Prerequisite: Speech Communication 101; junior standing. 3 hours.
223. **Argumentation: Theory and Practice.** Study of the theory of argument, e.g., evidence, reasoning, and construction of briefs; practice in formal and informal forms of debate and public discourse on current public questions. Prerequisite: Speech Communication 101; sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours.
230. **Interpersonal Communication.** Study of communication theory and its application to interpersonal relations; extensive discussion of problems of conflict and misunderstanding in personal affairs to facilitate the development of knowledge, insights, and skills in the processes of face-to-face interaction. Prerequisite: Speech Communication 101 and sophomore standing; by permission of the head of the department, the prerequisite may be waived for superior students, including James Scholars. 3 hours.
232. **Sex-related Differences in Language.** Same as Linguistics 232. A survey of perceived and actual differences between the uses of language by men and by women; emphasizes vocal language, although some attention is given to written expression. Prerequisite: A course in speech communication or in linguistics, or equivalent. 3 hours.
243. **The Oral Interpretation of Shakespeare.** Analysis and oral presentation of selections from Shakespeare's plays. Prerequisite: Junior standing; Speech Communication 141. 2 hours.
247. **Teaching of Speech.** Same as Secondary Education 247. Study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.
252. **The Rhetoric of Dissent.** A study of the rhetorical strategies and tactics employed in selected cases of dissent in American political and social life. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
253. **Case Studies in Public Discourse.** Detailed examination of selected cases of significant public discourse. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
254. **Freedom of Speech and the Ethics of Speech Communication.** Examination of the nature and variety of responses to value questions concerning communication; includes a survey of the evolution of and current controversies in freedom of speech. Prerequisite: Speech Communication 101 or 102, or consent of instructor. 3 hours.
255. **Directing, I.** Same as Theatre 281. Problems of script selection and interpretation, casting, rehearsing, and performances; techniques of composition, movement, and business for the proscenium stage; and direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
263. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Radio and Television 280, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.
290. **Individual Study.** Individual investigation of special problems. Prerequisite: Twelve hours of speech communication; a grade-point average of 4.25; and consent of head of department. 2 hours. May be repeated for a maximum of 4 hours.
291. **Honors Individual Study.** Individual investigation of special problems. Prerequisite: Twelve hours of speech communication; a grade-point average of 4.50; and consent of head of department. 2 hours. May be repeated for a maximum of 4 hours.
293. **Honors Senior Thesis.** Individual study leading to a thesis for honors in the Department of Speech Communication. Prerequisite: Senior standing; a grade-point average

of 4.50; and consent of head of department. 2 hours. May be repeated for a maximum of 4 hours.

301. **General Phonetics.** Same as Speech and Hearing Science 301. Basic principles of phonetic study, including observation and representation of pronunciation, ear training, and practice in transcription. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
307. **The Art of the Screen: Narration.** Same as Communications 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
308. **The Art of the Screen: Exposition and Persuasion.** Same as Communications 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action; lectures, discussions, and reports; and viewing of selected films and television programs. Prerequisite: Speech Communication 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
313. **Interpersonal Communication: Discussion and Interview.** Advanced study of theory, research, techniques, and training methods in interviewing and group discussion; emphasis on empirical research findings concerning communication processes in face-to-face groups. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
315. **Greek, Roman, and Medieval Rhetorical Theory.** Same as Classical Civilization 315. Examination of the development of rhetorical theory, criticism, and pedagogy in Western thought; analysis of the contributions of major figures and works from Homer to the Renaissance. Prerequisite: Junior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **Contemporary Rhetorical Theory.** Coverage of the major contributors to rhetorical theory from James and Winans to the present. 3 hours, or $\frac{1}{2}$ or 1 unit.
319. **Russian and East European Cinema.** Same as Communications and Slavic 319. Artistic, literary, and social aspects of cinema history, particularly Russian, Czech, Polish, and Yugoslavian; no reading knowledge of Russian required, except for Department of Slavic Languages and Literatures majors. 3 hours or $\frac{3}{4}$ unit.
320. **Argumentation and Public Decision Making.** Study of the philosophical, logical, and psychological bases of public decision making through discussion and debate. Prerequisite: Speech Communication 223 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
321. **Theories of Persuasion.** Survey of theories of persuasion derived from rhetorical, philosophical, and psychological sources and their application to persuasive discourse. Prerequisite: Speech Communication 221 or graduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
322. **Renaissance and Modern Rhetorical Theory.** Significant movements in the development of rhetorical theory in England, France, and America from 1500 to the present. Prerequisite: Senior standing. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
323. **Rhetorical Criticism.** Methods of interpreting and judging persuasive discourse with emphasis on political speaking and writing; lectures and practice in criticism. Prerequisite: Credit or concurrent registration in Speech Communication 322 or 350. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
324. **Persuasion in the Campaign and Movement.** Consideration of factors central to the sustained persuasive campaign or movement; special attention to the nature and functions of persuasion in the political campaign. Prerequisite: Speech Communication 221

- or 321, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
335. **Interpersonal Communication Processes.** Same as Communications 335. Study of the major processes involved in an individual's adjustment to the communication situations of everyday life; emphasis on the development of interpersonal competency and orientations, social perception, interpersonal sentiment and hostility, trust, and the social context as factors influencing the understanding and evaluation of interpersonal messages. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
342. **Oral Interpretation of Poetry.** Analysis and oral presentation of literature representative of various poetic forms. Prerequisite: Speech Communication 141. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
344. **Criticism of the Oral Interpretation of Literature.** Examination of theories of aesthetics and practical criticism and their application to the criticism of specific examples of the oral performance of literature. Prerequisite: Speech Communication 141 or graduate standing, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
345. **Oral Interpretation of Prose Fiction.** Modern concepts underlying the relationship of interpretation to the reader's experience of literature; discussions, reports, and oral interpretations of prose forms (including chamber theatre and readers' theatre). Prerequisite: Speech Communication 141 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
350. **Selected Topics in the History and Criticism of Public Discourse.** Study of selected periods and genres of public discourse in historical context, including British, American, French, Russian, German, Chinese, and Japanese. Prerequisite: One course in rhetorical criticism or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit. Additional work required for 1 unit credit. May be repeated with different context to a maximum of 12 hours or 4 units.
353. **Criticism of Contemporary Public Discourse.** Rhetorical criticism of selected aspects of contemporary public communication. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
363. **Advanced Dramatic Writing.** Same as Radio and Television 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Speech Communication 263 or Theatre 280; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit. May be repeated for a maximum of 6 hours or 2 units.
374. **Introduction to Empirical Research Methods in Speech Communication.** Introduction to descriptive and experimental methods in speech communication; intended to produce understanding and critical evaluation of research designs. 3 hours or $\frac{1}{2}$ unit.
375. **Speech Science, I.** Same as Linguistics 375 and Speech and Hearing Science 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms and to fundamental acoustics of speech. Prerequisite: Speech and Hearing Science 109 or 301, or Speech Communication 301, or consent of instructor. 4 hours or 1 unit.
376. **Speech Science, II.** Same as Linguistics 376 and Speech and Hearing Science 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Speech and Hearing Science 375. 4 hours or 1 unit.
383. **Development of Spoken Language.** Same as Speech and Hearing Science 383. Study of the correlates of language development from the prelinguistic period to adulthood. Prerequisite: Senior standing; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
387. **Introduction to Myth and Folklore.** Same as Comparative Literature, English, German and Slavic 387. Prerequisite: One year of college literature or consent of instructor. 3 hours or 1 unit.

400. **Studies in Dramatic Form and Structure.** Same as Theatre 401. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Consent of instructor. 1 unit.
403. **Seminar for Teachers of Speech.** Investigation of current principles, materials, and developments in the field of speech communication and of their relationship to the teacher. 1 unit.
417. **Contemporary Viewpoints in Speech Communication Theory.** Same as Communications 417. A readings seminar comparing the principal approaches to communication and rhetorical theory in the twentieth century along with a consideration of their philosophical assumptions. 1 unit.
429. **Seminar in Speech Communication.** Special topics in speech communication. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 4 units.
430. **Contemporary Theories of Oral Communication.** Systematic study of speech making and discussion as related to contemporary views of communication; examination of the theoretical literature and experimental evidence. Prerequisite: Consent of instructor. 1 unit.
436. **Seminar in Theories and Procedures of Discussion.** Intensive examination of selected problems of communication in small, task-oriented groups; evaluation of special instrumental forms, such as the unstructured group, the work group, the panel, and the lecture-forum; critical analysis of recent research in group communication as a means of making decisions and of changing attitudes and behavior. Prerequisite: Speech Communication 313 or equivalent. 1 unit.
437. **The Analysis of Interpersonal Interaction.** Same as Communications 437. Exploration of theory, methodology, and empirical findings of descriptive and experimental approaches to the analysis of verbal and nonverbal interaction processes, in both laboratory and naturalistic settings. Prerequisite: Speech Communication 335 or consent of instructor. 1 unit.
438. **Seminar in Rhetorical Theory.** Study of special topics in the history of rhetorical theory. 1 unit. May be repeated for a maximum of 4 units.
441. **Historical Background of Oral Interpretation.** Historical survey of British and American theories of interpretation. 1 unit.
442. **Seminar in Oral Interpretation.** Investigation of basic problems in the history, nature, and function of oral interpretation. Prerequisite: Speech Communication 441; consent of instructor. 1 unit.
443. **Seminar in the Oral Interpretation of Individual Literary Styles.** Examination of the literary style of an individual writer or selected writers, through research, discussion, and oral readings. See *Timetable* for current topics. 1 unit. May be repeated with a change in content to a maximum of 4 units.
465. **Seminar in Theatre Art.** Same as Theatre 407. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit.
468. **Seminar in Theatre History.** Same as Theatre 406. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
469. **Seminar in the Stage History of Classic English Plays.** Same as English 469 and Theatre 405. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit.
474. **Experimental Design in Speech Communication Research.** Detailed treatment of major issues and options in designs employed in speech communication research. Prerequisite: Speech Communication 374 or equivalent; introductory statistics course. $\frac{1}{2}$ or 1 unit. Additional work required for 1 unit credit.
495. **Special Problems.** Individual investigation of special projects not included in theses. Prerequisite: Consent of head of department. $\frac{1}{2}$ to 2 units. Open to master's candidates for a maximum of 1 unit, and to doctoral candidates for 1 or 2 units.
499. **Thesis Research.** 0 to 4 units.

INDUSTRIAL ENGINEERING

(See Mechanical and Industrial Engineering)

ITALIAN

(See Spanish, Italian, and Portuguese under Humanities, School of)

JAPANESE

(See Asian Studies)

JOURNALISM

Head of Department: Professor J. W. Jensen

Department Office: 119 Gregory Hall, Urbana

114. **Agricultural Communications Media and Methods.** Same as Agricultural Communications 114. Introduction to print, broadcast, visual, and other major communications media used to convey agricultural information; development of basic skills in communicating through those media. Prerequisite: Completion of campus rhetoric requirement. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
204. **Typography.** Study of type lore and design; type dimensions; printer's arithmetic and copyfitting; platemaking; printing processes; shop organization; and terminology. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours. News-editorial majors do not receive credit for this course.
211. **Newswriting.** Fundamentals of journalistic writing. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours. News-editorial majors do not receive credit for this course.
212. **Reporting.** News of public affairs. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 3 hours. News-editorial majors do not receive credit for this course.
214. **Agricultural Communications Strategy.** Same as Agricultural Communications 214. Coordinated approach to planning and carrying out programs of agricultural information and education using a variety of communications media. Students apply principles of strategy to actual communications problems of their choice. Prerequisite: Agricultural Communications 114 or consent of instructor. 3 hours.
215. **Contemporary Affairs.** Major news developments and their background; current political, economic, social, and scientific developments. Prerequisite: Journalism 212 or 350; registration in the College of Communications or consent of the college. 2 hours.
217. **History of Communications.** Same as Communications 217. Nature and development of communication systems; history of communication media; history of journalism, ad-

- vertising, and broadcasting; and communications in the modern world. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
218. **Communications and Public Opinion.** Same as Communications 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and the political order. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
220. **Processes and Systems of Communications.** Same as Communications 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
223. **Photojournalism.** A basic photography course designed to give students a proficiency in picture taking and processing and to acquaint them with picture editing and other illustrative problems. For current fees, see *Timetable*; cameras provided by the college. Prerequisite: Registration in the College of Communications or consent of instructor. 3 hours. News-editorial majors do not receive credit for this course.
231. **Mass Communication in a Democratic Society.** Same as Communications 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
233. **Publication Design and Production.** Theory of publication design; techniques of graphic production; and relationship of design and graphics to the realities of commercial printing. Prerequisite: Journalism 204 or consent of instructor. 2 hours.
241. **Law and Communications.** Same as Communications 241. Historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications 251 and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in journalism for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 1 or 3 hours.
321. **Editing.** Newspaper desk work; editing the news; correction of faulty news stories; handling wire copy; and attention to headwriting, news pictures, and makeup and design of newspaper pages. Prerequisite: Cr dit or concurrent registration in Journalism 204 and 212; registration in the College of Communications or consent of the college. 3 hours, or    to 1 unit. News-editorial majors do not receive credit for this course.
326. **Magazine Article Writing.** Preparation of feature stories and articles; techniques of marketing, market analysis, and publishing articles written in the course. Prerequisite: Journalism 211 or 350; registration in the College of Communications or consent of the college. 3 hours or    unit.
329. **The Rhetoric of Journalism.** Studies in journalistic method involving principally the analysis of structure and writing style as related to purpose; materials drawn from English and American journalism from the seventeenth century to the present; and emphasis on work published in twentieth-century American newspapers and periodicals. Prerequisite: Journalism 211 or 350, or consent of instructor. 2 hours or    unit.
330. **Magazine Editing.** Basic principles of editing for consumer, business, trade, and company magazines; communications theory, market analysis, editorial process, design process, production process, and distribution process as they relate to magazine publishing. Prerequisite: Credit or registration in Journalism 326 or consent of instructor. 3 hours or    unit.
350. **Journalism, I.** Fundamentals of journalistic writing; reporting news of public affairs.

Prerequisite: Enrollment as a major in the Department of Journalism or consent of department. 4 hours or 1 unit.

360. **Journalism, II.** Rational and aesthetic standards of visual communications; principles and techniques of making visual statements; and uses of visual technology in wedding verbal and nonverbal languages. For current fees, see *Timetable*. Prerequisite: Enrollment as a major in the Department of Journalism or consent of department. 4 hours or 1 unit.
370. **Journalism, III.** Developing a journalistic depth report; writing a depth report with a view to its final visual and graphic form; and conceptually editing the material of the depth report. Prerequisite: Journalism 350 and 360; enrollment as a major in the Department of Journalism or consent of the department. 3 hours, or $\frac{1}{2}$ to 1 unit.
380. **Journalism, IV.** Planning, researching, writing, and editing of depth reports; packaging depth reportage and reproducing for publication as a professional and public service. Prerequisite: Journalism 350 and 360; enrollment as a major in the Department of Journalism or consent of the department. 3 hours, or $\frac{1}{2}$ to 1 unit.
390. **Journalism, V.** Individually produced, in-depth, enterprise journalism as independent projects under minimal faculty supervision. Prerequisite: Journalism 350, 360, 370, and credit or registration in 380. 2 hours or $\frac{1}{2}$ unit.
468. **The Political Economy of Communications.** Same as Communications 468. Analysis of the structure, policy, and behavior of such media of communication as newspapers, magazines, books, postal service, telegraph, telephone, broadcasting, and film; special emphasis on their relationships to political order and the economy. Prerequisite: Consent of College of Communications. 1 unit.
470. **Communications and Popular Culture.** Same as Communications 470. Problems of cultural analysis related to the media of communications; social implications of communications research. Prerequisite: Consent of College of Communications. 1 unit.
471. **Proseminar in Communications, I.** Same as Communications 471. General discussion of the mass media of communications, their role as social institutions, and their control and support; content, audience, and effect of the mass media. Prerequisite: Consent of College of Communications. 1 unit.
472. **Proseminar in Communications, II.** Same as Communications 472. General discussion of the problem of communications, including the individual as a communicating system, symbolic processes, analysis of messages, psycholinguistics, and language as social behavior. Prerequisite: Consent of College of Communications. 1 unit.
473. **History and Theory of Freedom of the Press.** Same as Communications 473. Development of the Anglo-American press system and the idea of freedom of the press; contemporary mass media and their implications for freedom and democracy. Prerequisite: Consent of College of Communications. 1 unit.
474. **Communications Systems.** Same as Communications 474. Analysis of the structure and development of communications systems; examination of the role of communication in social change, political movements, and formal organizations. Prerequisite: Consent of College of Communications. 1 unit.
490. **Special Topics in Journalism.** Prerequisite: Consent of head of department. $\frac{1}{2}$ or 1 unit.
492. **Research Methods in Communications.** Same as Communications 492. Introduction to the methods of empirical research in the behavioral sciences applicable to research problems in human communication; emphasis on studies of mass communication. Lectures, readings, and laboratory practice. Prerequisite: Consent of College of Communications. 1 unit.
499. **Thesis Research.** Prerequisite: Graduate standing in journalism. 1 to 2 units.

KOREAN

(See Asian Studies)

LABOR AND INDUSTRIAL RELATIONS

Director of Institute: Professor M. Rathbaum

Institute Office: 247 Labor and Industrial Relations Building, Champaign

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
315. **The Economics of Poverty and Income Maintenance.** Same as Economics 315. Economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Industry and Society.** Same as Sociology 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; and the changing bases of managerial authority. Prerequisite: Sociology 100 or 6 hours of social science, or consent of instructor; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
341. **The Economics of Labor Markets.** Same as Economics 341. Study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems; topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; and employment and income policies. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **Unions, Bargaining, and Public Policy.** Same as Economics 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States, including theory of the labor movement; processes of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; and problems and policies of government intervention. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Economics of Manpower.** Same as Economics 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; and private industry and union manpower planning. Graduate credit is not given for both Labor and Industrial Relations/Economics 345 and 444. Prerequisite: Economics 101 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
347. **Labor Law, I.** Same as Law 347. A study of the National Labor Relations Act as amended, the preact history of the labor movement, and the judiciary's response thereto, with emphasis on understanding the problems, experiments, and forces leading to the enactment; includes the negotiation and administration of the collective bargaining agreement, especially the grievance arbitration procedure, its operation and place in national labor policy; and explores the relationship of the individual and the union. Prerequisite: Graduate standing or completion of first year of law curriculum. 3 hours or 1 unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
355. **Industrial Social Psychology.** Same as Psychology 355. Social psychological research and theory applied to industrial problems; emphasis on interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and

- group structure theory as aids in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **Psychology of Industrial Conflict.** Same as Psychology 357. Analysis of the causes and possible solutions of industrial conflict in terms of the behavior of individuals. Offered for industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
360. **Employee Benefit Plans.** Same as Finance 360. Analysis of the economic and financial issues involved in designing and administering employee benefit plans; major emphasis on group life, disability income, and medical care plans, and on qualified pensions and profit-sharing plans for regular employees; and some attention to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Business Administration 351, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
409. **Organizational Behavior.** Same as Business Administration 409. Examination and analysis of the organization as a social system and the impact of its various components on work attitudes and behavior; topics include the development of organizational structures, organizational effectiveness, decision making and policy formulation, leadership, and change. Prerequisite: Business Administration 408. 1 unit.
418. **Seminar in Industrial and Economic Sociology.** Same as Sociology 418. Discussion and individual research on such topics as industrialization, labor-management relations as group relations, the interrelations of industry and community, technology and the structure of controls in industry, and the problem of a social economics. Prerequisite: Labor and Industrial Relations 318 or consent of instructor. 1 unit.
420. **Formation of Public Policy.** Same as Political Science 420. Examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, and judicial activity. 1 unit.
435. **Motivation and Morale in Industry.** Same as Psychology 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; and modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
440. **Labor Economics.** Same as Economics 440. Survey of recent trends in the labor force, of real and money earnings, and of the distribution of national income; review of recent trends in these areas used as the basis for a critical economic analysis of contemporary English and American wage theory. Prerequisite: Economics 300 and 301. 1 unit.
441. **Labor Economics.** Same as Economics 441. Economic issues and implications involved in hours of work, employment and unemployment, and trade union institutionalism (the impact of the trade union upon the basic institution of a free enterprise economy); emphasis in all cases on the development of appropriate public policy. Prerequisite: Economics 300 and 301. 1 unit.
442. **Collective Bargaining.** Same as Economics 442. Development of a theory of the continuing interactions between union and management which define and modify the role of each and the terms of employment; use of appropriate social science concepts; and emphasis on the negotiating process, the structure of bargaining, and such issues as wages, worker security, and management authority, and on the interactions between the parties and the governmental process. Prerequisite: Consent of instructor. 1 unit. Graduate credit is not given for both Economics 343 and Economics/Labor and Industrial Relations 442.
443. **Problems and Practices of Labor Dispute Settlement.** Same as Economics 443. Seminar in the policies and practices of labor contract administration; comparative study of the fundamentals of grievance handling; analysis of mediation and fact-finding techniques; and special emphasis on the use of arbitration as a means of reducing industrial conflict. Prerequisite: Consent of instructor. 1 unit.
444. **Economics of Manpower Resources.** Same as Economics 444. Emergence of the manpower resource issue; population as a resource base; the labor force: measurement and characteristics, behavior under changing income, employment, and technology; women

as the dynamic factor in labor force growth; problems of utilization of labor force components: intellectual resources, older workers, and manual, white collar, Negro, and marginal forces; and issues of national manpower policy. Graduate credit is not given for both Labor and Industrial Relations/Economics 345 and 444. Prerequisite: Consent of instructor. 1 unit.

445. **Investment in Human Resources.** Same as Vocational and Technical Education 445. Activities which influence future monetary and psychic income by improving the resources in people; coverage of investments, including schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes; main emphasis on education; and a last section covering educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.
447. **Labor Union Organization and Administration.** Same as Economics 447. Analysis of the structure, functions, and government of the modern American trade union movement; survey of the environmental factors, objectives, and action programs with considerable emphasis on economic and internal institutional factors, including the roles of leaders, policy determination and execution, jurisdictional disputes, and governmental regulations. Prerequisite: Major in social science or consent of instructor. 1 unit.
448. **Problems of Personnel Management.** Same as Business Administration 411. Examination of the organization and administration of the personnel function in management; the relations of personnel administration to operating departments, and the scope of business and industrial personnel services; and an analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, carried out through case studies and direct industrial contacts. Specific consideration is given to problems up to and including placing the person on a job. Prerequisite: Consent of instructor. 1 unit.
450. **Management and Industrial Relations.** An analysis of the industrial relations function in management. Using case problems, research reports, and theoretical analyses, an examination is made of the development of the industrial relations function, alternate organizational approaches in dealing with employees and unions, the formation of labor relations policies, and management responsibilities in industrial relations. Prerequisite: Consent of instructor. 1 unit.
451. **Labor Law and Public Policy.** Same as Law 376. Analysis of current major policy issues in labor law and administration through the concepts and techniques of the lawyer and the labor relations specialist. Prerequisite: For law students, Law 347 or consent of instructor; for Institute of Labor and Industrial Relations and other graduate students, one semester of labor and industrial relations course work or consent of instructor. 2 hours or 1 unit.
454. **Foreign and International Labor Movements.** History and organization, economic and political policies of the major labor movements in the world; their international organizations; comparative analysis of particular problems confronting these movements; labor movements in underdeveloped areas; labor and economic development; and labor under totalitarian regimes. Prerequisite: Consent of instructor. 1 unit.
455. **Labor in Less Developed Countries.** The labor problem in economic development; the development of institutions and systems of industrial relations. Prerequisite: Consent of instructor. 1 unit.
456. **Industrial Relations Theory, I.** An integrated analysis of the principles of labor relations through the study of the works of the major theorists and their critics. Prerequisite: Consent of instructor. 1 unit.
457. **Industrial Relations Theory, II.** Continuation of Labor and Industrial Relations 456. Prerequisite: Labor and Industrial Relations 456. 1 unit.
458. **Faculty-Student Workshop.** Training and experience for Ph.D. students in the application of social science and industrial relations theory and research methodology to contemporary industrial relations problems through presentation and discussion of faculty and student research. Ph.D. students are required to give at least one paper, lecture, or other acceptable workshop presentation and to participate in workshop discus-

sions during the entire period of their campus residency for a total of 1 unit of credit. Prerequisite: Labor and Industrial Relations 456 and 457. 0 to 1 unit.

490. **Individual Topics.** A student in labor and industrial relations may register for this unit with the consent of the curriculum adviser and the adviser under whom the student will perform individual study or research. Such individual work may include special study in a subject matter for which no course is available or an individual research project, including on-the-job research in industry, which is not being undertaken for a thesis. 0 to 2 units.
492. **Research Seminar in Labor and Industrial Relations.** Systematic analysis of theories and procedures of the various social and physical sciences bearing on research in labor and industrial relations; primary emphasis on the process of integrating the approaches and techniques of the various social sciences with respect to the study of problems in labor and industrial relations as met in practice in management, the union, and government service, as well as in teaching and research in the field. Prerequisite: Major in social sciences or consent of instructor. 1 unit.
493. **Quantitative Methods in Labor and Industrial Relations.** Introduction to statistical concepts and methods in the social sciences and their application to industrial relations problems; familiarizes the student with modern methods of probability sampling, statistical inference, and multivariate analysis, and their application to current research problems in labor and industrial relations. Prerequisite: Any elementary statistics course. 1 unit.
496. **The Evolution of Labor-Management Relations in America.** Analysis and interpretation of the development of labor-management relations at the plant and industry levels from the stages of master and servant and master and journeyman in colonial times to the stage of constitutional government and industrial democracy in the present day. Prerequisite: Graduate standing in labor and industrial relations or consent of instructor. 1 unit.
497. **Collective Bargaining in Public Employment.** Same as Social Work 497, Administration, Higher, and Continuing Education 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
498. **Analysis of Organizations in Industrial Relations.** Intensive analysis of organizational behavior, with the main focus upon the theory of organizations as social institutions; concepts drawn from the various social sciences and applied to the principal organizations concerned with industrial relations; and examination of the internal dynamics of unions, managements, and government agencies, with special reference to decision-making processes, and their individual relations to the interactions among them. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Seminar.** For all students writing theses in labor and industrial relations at the M.A. and Ph.D. levels. 0 to 4 units (summer session, 0 to 2 units).

LANDSCAPE ARCHITECTURE

Head of Department: Professor R. B. Riley

Department Office: 205 Mumford Hall, Urbana

100. **Introduction to Landscape Architecture.** Survey of the practice and philosophy of landscape architecture. 1 hour.
101. **Introduction to Landscape Architecture.** Survey of the practice and philosophy of landscape architecture. 1 hour.

133. **Landscape Design.** Introduction to the fundamentals of design, including studies in two- and three-dimensional abstract and applied problems, basic elements and procedures of landscape design, and principles of landscape composition. Prerequisite: Credit or concurrent registration in Landscape Architecture 180, or consent of instructor. 5 hours.
134. **Site Design.** Principles and practices of site planning; orientation, circulation, and land use definitions and relationships applied to site scale problems; and application of site design process. Field trip required; see *Timetable* for current fees. Prerequisite: Landscape Architecture 133 or consent of instructor. 5 hours.
142. **Landform Design and Construction.** Introduction to the fundamentals of the earth's surface as a design element; limitations and uses of landforms; and methods of grading, surface drainage, and land surveying. 3 hours.
150. **Landscape Surveys.** Principles and practices of identifying, analyzing, and recording landscape resources. Field trip required; see *Timetable* for current fees. Prerequisite: Geography 103 or consent of instructor. 3 hours.
180. **General Drafting and Graphics.** Basic techniques and standards of drafting; lettering, views and projections, dimensioning, and shades and shadows. Prerequisite: Open to landscape architecture majors only. 2 hours.
181. **Visual Communications, I.** Principles of basic design and techniques in landscape architectural rendering. Prerequisite: Landscape Architecture 180 or consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Senior Honors Course.** Independent guided study and research in a selected area of landscape architecture; for candidates for honors in landscape architecture. Prerequisite: Senior standing in landscape architecture, a university grade-point average of 4.0, and consent of head of department. 1 to 6 hours. May be repeated to a maximum of 9 hours.
213. **People, Land, and Environment.** Nontechnical study of the landscape and the environment as products of a natural base worked upon by people, their technologies, and their beliefs; approach is both historical (from prehistory to science fiction) and problem oriented (the use of land, resources, and energy). 2 to 4 hours.
214. **History of Landscape Architecture.** Analysis of the development of landscape architecture as a result of environmental and cultural influences. 3 hours.
226. **Principles of Park Design.** Introduction to the theory of master planning and site design as related to recreation area development, administration, and operations. 2 hours.
235. **Recreation and Community Design.** Development of design solutions at site and master plan scale relative to community and recreational problems; emphasizes development of analysis and design techniques. Field trip required; see *Timetable* for current fees. Prerequisite: Landscape Architecture 134 or consent of instructor. 5 hours.
236. **Design Workshops, I.** Project design at various scales utilizing problems of a wide range of complexity and subject matter; concerns rural, community, and urban problems, housing, recreation, and open space; and emphasizes problem analysis and generation of innovative design alternatives. Students select from several sections depending on specific interests. Prerequisite: Landscape Architecture 235 or consent of instructor. 5 hours.
243. **Site Engineering.** Principles of design and layout of drainage, circulation, and utility systems. Prerequisite: Landscape Architecture 142 or consent of instructor. 3 hours.
244. **Landscape Construction.** Construction methods, materials, and procedures related to the design of landscape structures; development of design details and cost estimating. Prerequisite: Landscape Architecture 243 or consent of instructor. 3 hours.
246. **Professional Practice.** Professional responsibilities of the landscape architect; methods of practice; and preparation and execution of contracts and specifications. Prerequisite: Junior standing in landscape architecture or consent of instructor. 3 hours.
251. **Plant Materials and Design, I.** Ecological principles, study of plant communities, identification of native flora and perennials, and uses of plants in the landscape; introduc-

- tion to planting design. Field trips required. Prerequisite: Landscape Architecture 150, Botany 100 or 101, and Geography 103. 4 hours.
252. **Plant Materials and Design, II.** Biogeography; identification of native species, evergreens, and exotics; uses of plants in the landscape; and planting design projects. Field trips required. Prerequisite: Landscape Architecture 251. 4 hours.
253. **Planting Design.** Planting design philosophies; detailed and comprehensive design projects; management practices; technical documents; and plant identification. Field trips required. Prerequisite: Landscape Architecture 252. 4 hours.
282. **Visual Communications, II.** Continuation of Landscape Architecture 181, with emphasis on advanced rendering techniques; further exploration of the media and method of visual communication. Prerequisite: Landscape Architecture 181 or consent of instructor. 3 hours.
290. **Special Problems.** Supervised independent study, research, or special project in a selected area related to landscape architecture. Prerequisite: Junior or senior standing; consent of instructor and head of department prior to advance enrollment and registration. 1 to 6 hours. May be repeated to a maximum of 9 hours.
315. **Environmental Change and Public Policy.** Same as Urban Planning 315. Introduction to the applicability of social and political theory, methods, and techniques to environmental issues and problems; surveys federal, state, and local conditions related to changing patterns in environmental attitudes and natural resource obligations. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
337. **Regional Landscape Design.** Introduction to the process of physical planning, emphasizing land use policy and plan formulation; a regional case study is undertaken to develop analytical skills, to introduce the relationship between cultural and natural processes, and to explore the need for responsible political action. Prerequisite: Landscape Architecture 236 or consent of instructor. 5 hours or $1\frac{1}{2}$ unit.
338. **Thesis Design Project.** Terminal project; comprehensive landscape architectural development. Prerequisite: Landscape Architecture 337 or consent of instructor. 5 hours, or 1 to 2 units.
370. **Design-Behavior Interaction.** Critical discussion of notions and theories pertaining to the reciprocal effects of landscape architectural design and human behavior. 3 hours or $\frac{3}{4}$ unit.
417. **Land and Society: History, Theories, and Problems.** Historical and cross-cultural investigation of the use, shaping, and perception of the land-based environment; case studies, critical problems and issues, and theories of social-environmental interaction. Prerequisite: Consent of instructor. 1 unit.
436. **Advanced Landscape Design.** Comprehensive master planning and site design for large public, semipublic, and private properties; encouragement of special problems in collaboration with students from other disciplines. Prerequisite: Passage of special design examination or consent of instructor. 1 unit.
437. **Regional Landscape Design.** Detailed investigation of landscape resources and characteristics of large geographical areas; determination of land-use design proposals. Prerequisite: Landscape Architecture 441 or consent of instructor. 1 unit.
441. **Suburban Land Use Patterns.** Same as Urban Planning 441. Theoretical basis for land use plan design, including site qualities, offsite environmental impacts, relative location of activities, and sequences of development. $\frac{3}{4}$ unit.
442. **Spatial Design Methods.** Same as Urban Planning 442. Representations and solution procedures for problems involving the arrangement of land use activities in space; optimizing, approximate, and graphic methods, their applications, effectiveness, and efficiency; and experiments with computerized procedures. Prerequisite: Landscape Architecture 441 or consent of instructor. 1 unit.
457. **Landscape Management.** Investigation of management theories, policies, and practices which influence landscape preservation and development; emphasis on their cumula-

tive effects upon natural processes and aesthetic qualities. Prerequisite: Consent of instructor. 1 unit.

471. **Design-Behavior Fieldwork.** Preparation and application of field strategies to identify and to analyze behavioral trends as they relate to the physical environment; emphasis on user behavior in parks and playgrounds. Prerequisite: Landscape Architecture 370 recommended. 1 unit.
481. **Urban Design Studio, I.** Same as Architecture 481. Design of large building types and building complexes; megastructures; and collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 374; credit or concurrent registration in Urban Planning 384 or consent of instructor. 1 to 2 units.
482. **Urban Design Studio, II.** Same as Architecture 482. Design development studies of central business districts, movement systems, and residential communities; collaboration with other disciplines in research related to urban development. Prerequisite: Architecture 481, Urban Planning 384, or consent of instructor. 1 to 2 units.
487. **Seminar.** Preparation, presentation, and discussion of research papers on current and future areas of landscape architectural application. Prerequisite: Consent of instructor. ½ unit.
490. **Special Problems.** Nature and scope of projects to be determined by consultation between student and faculty adviser; open to landscape architecture majors as well as those from other disciplines who wish to engage in interdisciplinary work. Prerequisite: Consent of instructor. ½ to 2 units.
499. **Thesis Research.** Prerequisite: Graduate standing in landscape architecture. 0 to 2 units.

LATIN

(See Classics under Humanities, School of)

LATIN AMERICAN AND CARIBBEAN STUDIES

Director of Center: Professor M. H. Forster

Center Office: Room 250, 1208 West California Avenue, Urbana

195. **Freshman Seminar.** An intensive review of domestic and foreign factors influencing violence and social change in Latin America. Each semester a particular topic is selected. Prerequisite: Freshman James Scholar or other designation as a superior student. 3 hours.
295. **Special Topics: Conflict in Latin America.** A topical survey of social, economic, and political factors influencing conflict and violence in Latin American life. Each semester a particular topic is considered. Prerequisite: A basic course in a social science discipline. 3 hours.

LAW

Dean of College: Professor E. J. Cribbet

College Office: 209 Law Building, Champaign

301. **Contracts-Sales, I.** What promises are enforceable including unjust enrichment and reliance, offer and acceptance, mistake, unfairness and overreaching, unconscionability, Statute of Frauds, interpretation of contract language, conditions, and third party beneficiaries. 4 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
302. **Contracts-Sales, II.** Introduction to the Uniform Commercial Code, its interpretation and application; performance of contracts, including warranty obligations, breach, remedies for breach, impossibility and frustration of purpose, assignment and delegation, and third party rights in sold goods. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
303. **Torts, I.** Civil wrongs, including intentional torts (such as assault and battery), negligence, strict liability, medical malpractice, products liability, liability of owners and occupiers of land, libel and slander, unfair commercial practices, and the impact of insurance. 4 hours or 1 unit (summer session, 2 ½ hours or ½ unit).
307. **Property, I.** This is the basic first-year course in property law and is required of all students. Provides an overview of the law of land, with incidental coverage of personal property; includes the concept of property, acquisition of private property, recognized property interests, gratuitous transfer of property interests, commercial transfers (sale, lease), the use of property, and an introduction to environmental law. 3 hours or 1 unit.
308. **Property, II.** Continuation of Law 307. 2 hours or ½ unit.
309. **Criminal Law and Procedure.** The sources and purposes of the criminal law; the meaning of criminal responsibility; the characteristics of particular crimes; problems in the administration of criminal justice, with emphasis upon right to counsel, arrest, search, interrogation, lineups, and the scope and administration of exclusionary rules. 5 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
310. **Constitutional Law.** The apportionment of governmental power between the United States and the states, and the limitations on power resulting from the contract, equal protection, and due process clauses. 4 hours or 1 unit.
311. **Civil Litigation, I.** A study of modern civil courts and their historical development, including the structure of the judicial system, with particular emphasis upon the bases for adjudicatory power and upon remedies which may be afforded to and imposed upon civil litigants. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
315. **Legal Writing and Research.** Emphasis on development and improvement of skills in legal writing; assignments may include brief writing and preparation of legal memoranda and opinions; and training in legal bibliography. 2 hours.
316. **Moot Court.** A required first-year course. Students work in teams of two or three on an appellate brief of an actual case currently pending in the Illinois Court of Appeals. Two teams brief each case, one for the appellate and one for the appellee. Then, under the supervision of teaching assistants, students argue the merits of their case, in typical appellate argument fashion, before a panel of senior students, community lawyers, and professors. 1 hour. No graduate credit.
317. **Moot Court Board.** Preparation of an appellate brief; presentation of an appellate oral argument; participation in intramural, state, national, or international moot court competition. Prerequisite: Law 315 and 316. 1 hour. May be repeated to a maximum of 4 hours. No graduate credit.
319. **Civil Litigation, II.** Continuation of Law 311. Modern civil litigation, with emphasis upon pleading and parties, pre-trial proceedings, trial practice (except evidence), relationship between judge and jury, verdicts and judgments, and appellate review. Prerequisite: Second or third year of J.D. candidacy. 3 hours or 1 unit (summer session, 2 ½ hours or ½ unit).

320. **Organizations.** The basic legal consequences for individuals, organizations, and society, of the formation, control, and financing of organizations; includes the agency and employment relationship, unincorporated association, general partnership, limited partnership, closed corporation, public corporation, and non-business organizations. 4 hours or 1 unit (summer session, 5 hours or 1 unit).
322. **Commercial Law, I.** A study of major problems involved in commercial paper with special emphasis on the history and interpretation of the Uniform Commercial Code. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
323. **Administrative Law.** The functions of administrative tribunals in federal, state, and municipal government; the procedure before such administrative tribunals; and judicial relief from administrative decisions. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
326. **Evidence.** The law governing the proof of disputed issues of fact; function of the court and jury; competence and examination of witness; standards of relevancy; privileged communications; illegal evidence; hearsay rule; best evidence rule; presumptions; and judicial notice. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
328. **Taxation of Income and Wealth.** Introduction to federal income, estate and gift taxes, and Illinois inheritance tax; treats with income tax problems of individuals and business enterprise, and transfer taxes upon inter vivos and testamentary dispositions of wealth. Prerequisite: Second or third year of J.D. candidacy. 5 hours or 1 ½ unit.
329. **Family Property Transactions.** The means of transferring wealth, with primary emphasis on gratuitous transfers; the means available for making gratuitous transfers, including the validity and effect of testamentary instruments and trust deeds; and problems concerning the dispositive provisions of any type of instrument which transfers wealth. Prerequisite: Second or third year of J.D. candidacy. 4 hours or 1 unit (summer session, 5 hours or 1 unit).
330. **Restitution.** The legal and equitable remedies affording restitution of unjust enrichment, including the grant of money judgments in quasi-contractual actions and the imposition of constructive trusts and equitable liens in actions involving equitable wrongs. Unjust enrichment is considered in the context of the receipt of unsolicited benefits, benefits deriving from the commission of tortious acts, benefits deriving from wrongful appropriation of another's ideas, and benefits deriving from consensual transactions tainted by fraud or mistake. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
331. **Legislation.** The first division of the course deals with federal and state constitutional limitations upon the exercise of legislative power in a procedural sense, e.g., investigative powers, legislative structure, requirements relating to enactment of legislation, and role of courts in overseeing legislative action in these areas. The second division of the course deals with the formulation of legislative policy, the relationship of common law principles to legislative policy, and particularly the problems, rules, and methods employed by courts in the interpretation of legislation. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
332. **Patent Law.** Historical development of protection of ideas, inventions, and discoveries; patentability; securing the patent; amendment and correction of patents; and infringement remedies, defenses, and procedures. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
333. **Family Law.** The creation and dissolution of the family, legal relationships within the family, and related topics, such as the legal relationship between illegitimate and natural parent and legal relationships created by adoption; includes the law of marriage, divorce, annulment, separation, illegitimacy, custody, support, property, inheritance, and related rights; and also considers family law aspects of the movement for women's equality, the suitability in family litigation of the adversary system, and legal ethics as applicable to and practiced in the field of family law. 3 hours or 1 unit (summer session, 2 ½ hours or ½ unit).
335. **Securities Regulation.** Problems arising under federal securities laws administered by the Securities and Exchange Commission, as well as blue sky or state securities laws;

emphasis upon statutory and regulatory requirements imposed in connection with corporate financing. Prerequisite: Law 320. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).

336. **Unfair Trade Practices.** The regulation of competitive business behavior at common law and under federal and state statutes; trademarks, copyrights, design patents, trade secrets, protection of ideas, commercial disparagement, false advertising, and price discrimination. 2 to 3 hours, or ½ to 1 unit (summer session, 2 ½ hours or ½ unit).
337. **Commercial Law, II.** Secured transactions (personal property securities) under the Uniform Commercial Code. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
339. **Conflict of Laws.** The study of problems having relationship with two or more states or nations involving individual litigants or potential litigants; includes such matters as jurisdiction of courts, judgments, torts, workmen's compensation, contracts, property, family relationships, trusts and estates, business organizations, and governmental activities. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
340. **Urban Government.** History and functions; judicial, legislative, and administrative control; creation, dissolution, and changes in structure; law-making powers; finance; planning and development functions; regulatory powers; contracts; tort liabilities; and federal-local and interlocal relations. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
341. **Natural Resources.** Legal problems associated with the use of certain land, water, and mineral resources, including energy resources; principal emphasis on public management and regulation. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
342. **Real Estate Financing.** A study of real estate mortgages. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
344. **Creditors' Rights.** Remedies of the delinquent debtor and his creditors under the Bankruptcy Act; liquidation and rehabilitation; and exercises in bankruptcy procedure. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
345. **Civil and Political Rights.** Basic problems in the relation of the individual to government and in the protection of the rights of minority groups. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
347. **Labor Law, I.** Same as Labor and Industrial Relations 347. A study of the National Labor Relations Act as amended, the preact history of the labor movement, and the judiciary's response thereto, with emphasis on understanding the problems, experiments, and forces leading to the enactment; includes the negotiation and administration of the collective bargaining agreement, especially the grievance arbitration procedure, its operation and place in national labor policy; and explores the relationship of the individual and the union. Prerequisite: Graduate standing or completion of first year of law curriculum. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
348. **International Law.** The nature, sources, and subjects of international law and its place in the control of international society; includes an examination of the law of jurisdiction, territory, recognition and succession of states, rights and immunities of states in foreign courts, diplomatic immunities, treaties, protection of citizens abroad, settlement of international disputes, war and neutrality, the United Nations, and the International Court of Justice. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
349. **State and Local Taxation.** A survey which stresses the constitutional and statutory bases of state and local tax systems; considers the fiscal and economic policy aspects of the tax structure; and includes the power and purposes of taxation, the operation and administration of the general property tax, jurisdiction of the states to impose various types of taxes, and special problems relating to the operation of income, sales, and business excise taxes. 2 hours or ½ unit (summer session, 2 ½ hours or 1 unit).
350. **Government Regulation.** Regulatory control of business activity; restriction of entry; price, service and wage regulation; and control of price and service discrimination under the Robinson-Patman Act. 3 hours or 1 unit (summer session, 2 ½ hours or ½ unit).
351. **Jurisprudence.** The place of law in society; the nature, goals, and methods of law; and

the relation of law and social science. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).

353. **Business Planning.** Examination of planning situations wherein tax, corporations, corporate finance, securities regulation, and accounting materials are interrelated; organization of close corporations and public companies, corporate distributions and recapitalizations, sale of corporate businesses, corporate acquisitions and mergers, and corporate separations; and problems requiring written opinions and solutions. 4 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
354. **Empirical Evidence in Discrimination.** The determination and proof of discrimination in employment and other areas by means of statistical evidence. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
355. **Antitrust Law.** Study of anticompetitive practices by business firms, including price-fixing, monopolization, mergers, exclusive dealing, price discrimination, and incipient restraints of trade. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
356. **Federal Courts.** Examination of the relationship of federal courts to other organs and federal government, particularly congressional control over jurisdiction, including availability, appropriateness, and extent of judicial review. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
357. **Legal Accounting.** Introduction to the basic concepts of double-entry and accrual accounting, followed by a critical and comparative appraisal of generally accepted accounting principles in relation to legal concepts governing various business transactions. 2 hours or ½ unit (summer session, 2 ½ hours or 1 unit).
358. **Modern Social Legislation.** Examination of the legal structure and underlying economic and social policies of income maintenance programs and proposed reform; includes old age and survivor's insurance under the Social Security Act, governmental regulation of private pension systems supplementing public provision for old age, aid to families with dependent children under the Social Security Act, child welfare provisions, health maintenance provisions, and various other welfare, social entitlement, and related income redistribution programs. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
360. **Legal Drafting and Law Office Practice.** A practical course on the drafting of legal documents; a study of the organization and management of a law office. 2 hours. No graduate credit.
362. **Trial Advocacy.** Examination of the problems of advocacy and tactics at the trial level. Students engage in actual trial work, including witness preparation, opening and closing statements, direct and cross examination, and jury instructions; demonstrations are conducted by staff and visiting judges and practitioners; and the course culminates with students conducting trials before a judge and a jury. Prerequisite: Second or third year of J.D. candidacy. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
363. **Environmental Law.** The regulatory aspects of environmental law; examination of the major areas of governmental control (air pollution, water pollution, noise pollution, solid waste disposal); the roles of federal and state governments; the operation of environmental impact statement procedures; citizen participation; and private remedies. Prerequisite: Second or third year of J.D. candidacy. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
364. **Urban Planning and Land Use Regulation.** The legal and administrative aspects of land development and regulation in an urban society; the techniques and problems of planning; the tools of plan effectuation, such as zoning, subdivision regulation, renewal and redevelopment, housing programs; and the allocation of decision-making functions among various levels of government. 3 hours or 1 unit (summer session, 2 ½ hours or ½ unit).
365. **Taxation of Business Enterprises.** Federal income tax law related to taxation of corporations, shareholders, partnerships, and partners. Prerequisite: Law 320 and 328. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).

369. **Soviet Law.** Soviet conceptions of the role of law as evidenced both in theory and in practice; emphasis on highlights of Soviet law, with comparison to the common-law and civil-law traditions; and study of Soviet court and legislative materials to determine characteristic patterns with respect to: constitution and administration, the relation of the individual to the state and to society, legal regulation of property and productive institutions, private relationships, and international law. 2 to 3 hours, or ½ to 1 unit (summer session, 2 ½ hours or 1 unit).
370. **Labor Law, II.** Advanced problems in the law of industrial relations, with particular emphasis on the negotiation and administration of the collective bargaining agreement; the relation between the individual and the union. Prerequisite: Law 347 or consent of instructor. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
371. **Seminar in Selected Legal Problems.** Introduction to the methods and materials of legal research; discussion of selected topics; each student investigates a topic approved by the instructor and presents the results of the investigation orally to the class and in writing to the instructor. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit). May be repeated.
372. **Problems in Estate Planning.** Selected problems in the planning of estates which will serve to integrate the basic materials in property, trusts, wills, income, estate, and gift taxation. Prerequisite: Law 328 and 329. 2 hours or ½ unit (summer session, 2 ½ hours or ½ unit).
373. **Advanced Criminal Procedure.** Problems in the administration of criminal justice, with emphasis upon the commencement of formal proceedings (bail, decision to prosecute, grand jury, preliminary hearing, location of prosecution, scope of prosecution, speedy trial); the adversary system (pleas, discovery, jury trials, prejudicial publicity, ethical problems, double jeopardy); and post-conviction review (post-trial motions, appeals, habeas corpus, related post-conviction remedies). Prerequisite: Law 309 and 310. 3 hours or 1 unit (summer session, 2 ½ hours or ½ unit).
374. **Torts, II.** Focuses on the traffic victim and his claim for compensation; compares the present common law method with various schemes of social insurance, both public and private; explores problems of coordinating, as well as comparing, any such scheme of social legislation with the tort system and with other social and private insurance arrangements, such as workmen's compensation, accident and health insurance, Social Security, etc.; and considers both broad questions of social policy and technical drafting problems. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
375. **Government Contracts.** A study of the way the United States does business; differences in dealing with the government as compared to private parties; awarding of contracts and contractual clauses, especially those allocating risks; and adjudication of contract disputes. 3 hours or 1 unit (summer session, 2 ½ hours or 1 unit).
376. **Labor Law and Public Policy.** Same as Labor and Industrial Relations 451. Analysis of current major policy issues in labor law and administration through the concepts and techniques of the lawyer and the labor relations specialist. Prerequisite: For law students, Law 347 or consent of instructor; for Institute of Labor and Industrial Relations and other graduate students, one semester of labor and industrial relations course work or consent of instructor. 2 hours or 1 unit.
377. **Consumer Credit.** Existing patterns and proposed changes in consumer credit law; finance charge regulations, special licensing for merchandisers of consumer credit, disclosure of finance charges, door to door selling, home improvement financing, cutting off defenses, creditor remedies problems including garnishment, wage assignments, and deficiency judgments, and administrative control of creditor practices. Prerequisite: Law 322. 2 hours or ½ unit.
378. **Juvenile Courts.** The laws relating to juveniles, including the historical relationship of the criminal law with children; the evolution of state and federal decisional law providing for the special handling of children under specified ages who engage in conduct deemed to be delinquent; emphasis on the procedural and constitutional rights of

children accused of wrongful conduct. Prerequisite: Law 309. 2 hours or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or $\frac{1}{2}$ unit).

379. **Law of Corrections and Prisoners' Rights.** An examination of the present system of corrections, including a study of procedural and substantive rights of incarcerated persons; the sentencing process; post-conviction remedies and programs, focusing on probation and parole; and alternatives to the present system. Prerequisite: A basic course in criminal law and procedure. 2 hours or $\frac{1}{2}$ unit.
382. **Comparative Law.** Comparative law is a method, an approach to legal problem solving, rather than a subject matter in the traditional sense. The course attempts to sharpen students' perceptions of their own law by providing them with a measuring stick; it is not primarily concerned with specific rules of foreign law or with proficiency in a specific foreign legal system. 2 hours or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
383. **Law of Professional Responsibility.** A study of ethical issues arising in the practice of law with particular reference to the requirements of the American Bar Association Code of Professional Responsibility. Prerequisite: Second year of J.D. candidacy. 1 or 2 hours, or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
384. **Current Legal Problems.** Intensive study of current legal problems; based upon recent court decisions, recent legislation, pending law reform proposals, or empirical studies; subject matter varies from semester to semester. 3 hours or 1 unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
385. **International Business Transactions.** Doing business abroad: export-import regulations, use of foreign commission merchants, licensing of patents and know-how, investment and exchange problems, establishing a foreign operation (including forms of business organization available abroad), and application of United States and foreign antitrust law to the business operation. Prerequisite: Law 322. 2 hours or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or $\frac{1}{2}$ unit).
386. **Taxation of International Transactions.** Survey of the problems in U.S. taxation of foreign persons and foreign income, with special emphasis upon foreign business transactions of U.S. corporations. Prerequisite: Law 328. 2 hours or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or $\frac{1}{2}$ unit).
387. **International Economic Organizations.** A survey of the principal international economic organizations (GATT, OECD, ECE) and of international monetary and investment institutions (IMF, IBRD, AID); an intensive study of the European Common Market, particularly of its laws relating to trade barriers, establishment of companies, and antitrust; and United States legislation in the field of international trade (Trade Expansion Act of 1962). 3 hours or 1 unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
388. **Law and Psychiatry.** Contemporary psychiatric theory and its relevance to various legal issues; psychiatric disorders, their etiology and treatment; and problems of prediction and prevention of deviant behavior in the context of the administration of the criminal and mental health laws. 3 hours or 1 unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
389. **Corporate Finance.** The impact of legal regulation and financial theory on the formation, financing, and value of corporations; alternative methods for utilization of surplus funds; and controls over transactions in shares. Prerequisite: Second year of J.D. candidacy. 2 hours or $\frac{1}{2}$ unit.
390. **Insurance.** Concentration on such fundamentals as the formation of the insurance relation and the principle of indemnity; includes persons and interests protected, the risks transferred, rights at variance with policy provision, claims processes, and regulation of insurance. Assignments outside of class consist of a programmed set of technical legal problems; classroom lectures supplement the problems, often focusing on broader aspects of the subject matter. Prerequisite: Second year of J.D. candidacy. 2 hours or $\frac{1}{2}$ unit (summer session, 2 $\frac{1}{2}$ hours or 1 unit).
391. **Legal Problems.** Preparation of comments on recent decisions for publication in the

University of Illinois Law Forum. Open to students selected for superior achievement in two or more semesters of law study. 1 hour. May be repeated. No graduate credit.

395. **Clinical Training.** Student field work in the offices of the Champaign County Legal Services Agency, Vermilion County Legal Services Agency, Champaign Human Relations Commission, local City Attorneys, State of Illinois Department of Mental Health, Champaign County State's Attorney, Champaign County Public Defender, and other public agencies. Students engage in legal and investigative work under the supervision of agency attorneys or other administrative personnel; this work may include conducting client interviews, doing legal research, preparing legal documents, pleadings, and briefs, and in some cases, engaging in the trial of actual cases. 1 hour. May be repeated up to four times. No graduate credit.
399. **Research in Special Topics.** Individual research on a special problem selected in consultation with the instructor. 1 to 4 hours, or $\frac{1}{2}$ to 1 unit.
402. **Introduction to U.S. Law.** An intensive introduction to the American legal system for graduate law students with prior professional training in non-common law legal systems; stresses the functioning of basic U.S. legal institutions and the techniques of American legal research. 1 unit.
499. **Thesis Research.** 0 to 3 units.

LAW AND SOCIETY

Director of Program: Professor R. Simon

Office: 318a Lincoln Hall, Urbana

460. **Proseminar in Law and Society, I.** Interdisciplinary course for faculty and graduate students working in the law and society area. Each meeting includes a presentation of current work by faculty and/or students. Students are required to do original research under supervision. Prerequisite: Consent of instructor for students from nonparticipating units. $\frac{1}{2}$ unit.
461. **Proseminar in Law and Society, II.** Continuation of Law and Society 460. Prerequisite: Consent of instructor for students from nonparticipating units. $\frac{1}{2}$ unit.

LEISURE STUDIES

Head of Department: Professor J. J. Bannon

Department Office: 104 Huff Gymnasium, Champaign

100. **Leisure: Its Uses and Resources.** Philosophical foundations of leisure and recreation; history of the development of parks and man's organized efforts to meet his leisure needs; introduction to present patterns of organized recreation; professional preparation for the field; and evaluation of student skills and experience. 2 hours.
110. **Foundations for Delivery of Leisure Services.** Introduces the leisure studies major to enabling legislation, fiscal concerns, standards for planning, problems of cities, and the relationship of professional organizations to recreation and park services. 2 hours.
130. **Introduction to Therapeutic Recreation.** Introduction to concepts and principles of therapeutic recreation; types of illnesses and disabilities; settings; programming and services; and role of the therapeutic recreator. 2 hours.
140. **Principles of Camping.** Objectives, organization, techniques, counseling, activities, and evaluation. 3 hours.

141. **Introduction to Outdoor Education and Recreation.** Philosophy and principles; programs and methods used by various types of institutions; and field experience. Prerequisite: Leisure Studies 100 or consent of instructor. 2 hours.
180. **Recreation Program Laboratory, I.** Survey of a number of recreation program activities; through a series of workshops, students are instructed in leadership skills in such program areas as recreational dance, drama, music, arts and crafts, and social recreation. 1 hour.
181. **Recreation Program Laboratory, II.** Survey of a number of recreation program activities; through a series of workshops, students are instructed in leadership skills in such program areas as recreational dance, drama, music, arts and crafts, and social recreation. 1 hour.
182. **Basic Recreation Field Experience.** Directed field experience in public and private recreation agencies; gives students majoring in recreation an introduction to working in actual field situations; students work in University-approved agencies of their own choice four to thirty-two hours each week. Prerequisite: Leisure Studies 100 and 110. 1 or 2 hours. Must be repeated in a different responsibility classification.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Leadership in Leisure Delivery Systems.** Introduces the student to the various theories of leadership applicable to situations that exist in the field of leisure studies; provides practice in various leadership settings and techniques for the evaluation of leadership performance. Prerequisite: Leisure Studies 100 or 110. 3 hours.
210. **Theories and Methods of Supervision.** Concepts, principles, and objectives of supervision; the nature of the supervisory relationship; supervisory functions and processes; identification and application of methods and techniques; and organizational and operational patterns of supervision in recreation and park settings. Prerequisite: Leisure Studies 180 and 181, or consent of instructor. 3 hours.
215. **Recreation Program Development.** Theory and practice in recreation program development in the various recreation settings, including public, private, and commercial operations; core programming and programming dictated by the needs of the field, setting, or clientele; and program evaluation. Prerequisite: Leisure Studies 100 and 200, or consent of instructor. 3 hours.
250. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, or related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 to 3 hours. May be repeated for a maximum of 4 or 6 hours.
260. **Honors Seminar.** Same as Health Education 260 and Physical Education 290. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a maximum of 6 hours.
272. **Organization of Aquatic Programs.** Same as Physical Education 272. History of athletics; leadership training methods; swimming pool sanitation; pool and beach control; and operational records. 2 hours.
274. **Urban Leisure Systems.** Orientation to the urban and inner-city setting and to the role of leisure within this community; methods and techniques effective in out-reach programs; guest lecturers in related fields such as urban planning, social work, etc.; guest speakers from local community; field trips and field experience; and readings from several disciplines as relevant. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.
280. **Professional Seminar.** Seminar discussions to prepare students for supervisory internship; placement; agency-university relationships; evaluation; resume writing; and professional code of ethics. Prerequisite: Leisure Studies 182; junior standing; consent of the coordinator of field work programs. 1 hour.

- 282. Field Practicum, I.** Students are assigned to approved field instruction agencies in a supervisory capacity for a minimum of forty hours per week for an eight-week session; both the agency and the University provide supervision. Prerequisite: Leisure Studies 280. 4 to 8 hours. May be repeated to a maximum of 8 hours.
- 283. Field Practicum, II.** Students are assigned to approved field instruction agencies in a supervisory capacity for a minimum of forty hours per week for an eight-week session; both the agency and the University provide supervision. Prerequisite: Leisure Studies 282. 4 hours.
- 290. Research in Leisure Studies.** The place of research in recreation and parks; research design; data collection, processing, and analysis; use of completed research; and development of an appreciation of and an ability to evaluate and utilize research rather than an ability to conduct research. Prerequisite: Senior standing; consent of instructor. 3 hours.
- 299. Off-Campus Study.** Provides campus credit for foreign or domestic study completed off-campus. A student's proposal for study must have prior approval of the major department and the college office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Advanced standing and approval of major department and college. 0 to 16 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 32 hours.
- 310. Introduction to Administration.** Organization of public and private agency programs, leadership, facilities, and services; introduction to recreation administration. Prerequisite: Leisure Studies 100; advanced undergraduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 315. Play Theories and Their Implications.** Classical and modern theories of play; critical analysis of definitions, concepts, and assumptions and of extant research and research strategies; implications for programming and planning for play. Prerequisite: Leisure Studies 110 and 215; junior standing; or consent of instructor. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
- 320. Park Management.** An intensive study of the principles, practices, and problems involved in managing public park systems; designed to provide a professional background including the history of parks, organization, planning, examination of facility design and layout, maintenance, finance, and operation of park systems. Prerequisite: Senior standing in leisure studies, or consent of the instructor; credit in the following courses or equivalent: Landscape Architecture 226; Urban Planning 171; Political Science 305; Leisure Studies 280. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 321. Recreational Use of Public Lands.** Study of lands in the public domain and their historical, current, and potential use for outdoor recreation; an analysis of land, woods, and water in the public domain; the demand for outdoor recreation; multiple-use concept of natural resources; functions and policies of federal and state governments and their agencies; the economics of outdoor recreation; and the future of outdoor recreation in America. Prerequisite: Leisure Studies 100; Economics 108; Geography 214; or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 330. Principles of Therapeutic Recreation.** Concepts, principles, objectives, methods, and settings of recreation for the ill and handicapped. Prerequisite: Advanced undergraduate or graduate standing; Leisure Studies 100, and 180 or 181, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 331. Recreation Leadership for Special Groups.** Leadership theory and methods applied, in recreational settings, primarily to groups of the mentally ill, the mentally retarded, the physically disabled, and those with conduct disorders. Prerequisite: Leisure Studies 110 and 130. 3 hours, or $\frac{1}{2}$ to 1 unit.
- 343. Social Psychology and Motor Behavior.** Same as Physical Education 343. The use of social psychological theory and methods in the study of motor behavior; emphasis given to the influence of social psychological processes on motor skill acquisition, including such variables as social facilitation, competition, aggression, attitudes, and personality. Prerequisite: Educational Psychology 390 or Psychology 201, or consent of instructor. 4 hours or 1 unit.

348. **Social Problems Related to Physical Activity and Sport.** Same as Physical Education 348. A seminar with field study on physical activity and sport for marginal, deviant, or sociopsychologically deprived groups. Prerequisite: Six hours in the social sciences or consent of instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
349. **Analysis of Small Groups in Play and Sport.** Same as Physical Education 349. The methodology of small group research and analysis of the small group in play and sport; discussion of culture, social structure, and personality structure in the group; and class and student observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
381. **Management Internship.** Work-study experience in the management aspects of leisure service delivery systems. Students are assigned to agencies in their special fields of study and are closely supervised by University faculty. Prerequisite: Leisure Studies 282 and 283, or graduate standing. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
401. **Foundations of Leisure Studies.** Basic philosophical, historical, and scientific foundations and developments in leisure and recreation; analysis of recreation values as related to other contemporary individual and community needs; and functions and settings of organized recreation, special problem areas, and current issues. Prerequisite: Leisure Studies 100 or equivalent. 1 unit.
402. **Leisure Systems Administration.** Strengthens the graduate student's knowledge of the public administration of recreation programs and services provided by municipal, county, state, and national departments and agencies as related to the general well-being of individuals, families, and communities. Prerequisite: Basic course in the organization of recreation or equivalent. 1 unit.
403. **Evaluation of Leisure Resources and Programs.** Methods and techniques of determining recreational needs, interests, and opportunities of individuals and communities through surveys, studies, and appraisals; evaluation and appraisal of community recreation programs and services; and research in the field of recreation. Prerequisite: Leisure Studies 100 or 310, or equivalent; a course in tests or measurement statistics. 1 unit.
404. **Outdoor Education and Recreation.** Philosophy, essential principles, methods, techniques, resources, administrative and program practices for outdoor education and recreation. Prerequisite: Leisure Studies 140 or equivalent; one undergraduate course in any one of the following: biology, botany, geology, or zoology. 1 unit.
443. **Group Dynamics in Sport.** Same as Physical Education 443. Presentation of theories and methods in the study of the psychology of small group behavior in sport; an analysis of the literature pertaining to group processes, with particular emphasis on group performance in sport. Prerequisite: Leisure Studies 343 or consent of instructor. 1 unit.
490. **Seminar.** Student presentation of thesis studies, informal discussions, and critical analysis of problems; informal lectures by invited speakers. 0 credit.
493. **Special Projects.** Independent research on special projects. Open only to students majoring in leisure studies. Prerequisite: Leisure Studies 403 or equivalent. $\frac{1}{2}$ to 2 units.
494. **Special Topics in Leisure Studies.** Lecture courses in topics of current interest; specific subject matter will be announced in the *Timetable*. Prerequisite: Will be determined for each course offered and will be indicated in the *Timetable*. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** Preparation of thesis in recreation. 0 to 4 units.

LIBERAL ARTS AND SCIENCES

Program Administrator: Professor R. K. Applebee

Program Office: 294 Lincoln Hall, Urbana

110. **Workshop-Tutorial.** A workshop-tutorial in special topics for students in the experimental living learning unit, Unit One only; topics and hours to be arranged. Prerequisite: Permission of the director of Unit One. 1 to 6 hours.
140. **Thought and Structure in Physical Science.** An approach to the structure of scientific theories using some of the subject matter of descriptive astronomy and physics; emphasis on the nature of scientific thinking and the criteria for the validity of scientific ideas. Lecture, laboratory, and discussion. 4 hours.
141. **The Physical Universe.** Study of the various forms of universal energy, using some of the subject matter of cosmology and modern physics; emphasis on such items as man's ability to measure very far distances and to interpret the evidence for the origin of the solar system and of the universe. Prerequisite: Liberal Arts and Sciences 140. 4 hours.
142. **Physical Science in Modern Society.** Same as Geology 142. Physical science for nonscience majors; emphasizes the basic chemical and physical aspects of the earth's environmental systems and the impact of modern technology on these systems. 3 hours.
143. **Environmental Physical Science.** Same as Geology 143. Physical science for nonscience majors; emphasizes earth processes and resources relevant to modern society including the availability and by-products of utilization of energy and water resources and the limitations imposed by earth processes on society. Students may not receive credit for Geology/Liberal Arts and Sciences 143, and Geology 101 or 104. 3 hours.
197. **Freshman Seminar in Physical Science.** A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Galileo to Faraday have supported new scientific concepts and theories; discussion, individual research, and reports; and laboratory work replicating significant experiments. Prerequisite: James Scholar or designation as a superior student; consent of instructor. 4 hours.
198. **Freshman Seminar in Physical Science.** A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Maxwell to modern times have supported new scientific concepts and theories; discussion, individual research, and reports; and laboratory work replicating significant experiments. Prerequisite: Liberal Arts and Sciences 197 or consent of instructor. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
210. **Experimental Seminar.** Seminar or workshop in special topics for Unit One students only; topics to be arranged in areas not treated by regular course offerings, or in areas within the expertise of the Unit One staff. Credit toward college or departmental requirements is contingent on approval of the appropriate unit. Prerequisite: Consent of instructor and sophomore standing. 3 hours.
299. **LAS Study Abroad.** Provides campus credit for foreign study. A student's proposal for study abroad must have prior approval of the major department and the College of Liberal Arts and Sciences office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Permission of the student's major department and the College of Liberal Arts and Sciences office. 0 to 15 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 30 semester hours per academic year or to a total of 36 semester hours, all of which must be earned within one calendar year.

LIBRARY SCIENCE

Director of Graduate School: Professor H. Goldhor

School Office: 329 Library, Urbana

195. **Introduction to Library Use.** Use of the card catalog, periodical indexes, encyclopedias, dictionaries, and other reference books. Intended for freshman and sophomores; not to be counted toward the undergraduate minor in library science. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
300. **Foundations of Librarianship.** The development of the library as an institution in relation to the society it serves, the operation and organization of libraries, building the library collection, types of reference tools, and the cataloging and classification of books and other materials; serves as an orientation to librarianship as a profession. Prerequisite: Consent of department. 6 hours or 2 units.
301. **Bibliography.** Covers enumerative bibliography, the practices of compiling lists; analytical bibliography, the design, production, and handling of books as physical objects; and historical bibliography, the history of books and other library materials, from the invention of printing to the present. Prerequisite: Library Science 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
302. **Science Materials for Nonspecialists.** Aims (a) to acquaint students with library materials in science and technology that serve the interests and needs of nonspecialist users of school, college, and public libraries, and (b) to develop proficiency in their selection, evaluation, and use for general reading and for reference work; centered around current interests and information needs of library users with limited technical backgrounds. Prerequisite: Library Science 300 or consent of instructor. 3 hours or 1 unit.
303. **Library Materials for Children.** Selection and use of library materials for children in public libraries and elementary school media centers, according to their needs in their physical, mental, social, and emotional development; deals with the standard selection aids for all types of print and nonprint materials and develops the ability to select and describe children's materials according to their developmental uses. Students may not receive credit for both Library Science 303 and Elementary and Early Childhood Education 304. Prerequisite: Library Science 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
304. **Library Materials for Young Adults.** Evaluation, selection, and use of library materials for young adults in school and public libraries and community organizations, according to personal and curricular needs; studies selection sources for all formats of materials and explores techniques for utilization of materials. Prerequisite: Library Science 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
308. **Audiovisual Services in Libraries.** Designed to acquaint students with the nonprint media responsibilities of libraries; includes the evaluation, selection, and acquisition of software and hardware, the utilization of media in various types of libraries (by individuals and groups, in formal and informal programs), and the administration of integrated media collections (films, recorded sound, video, and exhibits). Prerequisite: Library Science 300 or consent of instructor. 3 hours or 1 unit.
309. **Storytelling.** Fundamental principles of the art of storytelling including techniques of adaptation and presentation; content and sources of materials; story cycles; methods of learning; practice in storytelling; and planning the story hour for the school and public libraries, for recreational centers, for the radio, and for television. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Typographic Disciplines of the Book.** The study of the book as a manufactured object; emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration; and extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or $\frac{1}{2}$ unit.
354. **Audio-Visual Communication.** Same as Elementary and Early Childhood Education 354 and Secondary Education 354. An analysis and application of those introductory

aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or ½ or 1 unit.

405. **Library Administration.** Designed to supply knowledge of the internal organization of libraries and of the principles of library administration; emphasis on comparison of the conditions found in the several kinds of libraries and on applications of the general theory of administration. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
406. **Media Programs and Service for Children and Young Adults.** The role, problems, and needs of children's and young adults' library services in the school and public library. A two-day field trip required; estimated expense, \$35.00. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
407. **Cataloging and Classification, I.** Theory and application of basic principles and concepts of descriptive and subject cataloging; emphasis on interpreting catalog entries and making a catalog responsive to the needs of users; provides beginning-level experience with choice of entries, construction of headings, description of monographs (and, to a lesser extent, of serial publications and nonprint media), filing codes, Dewey and Library of Congress classification systems, and Library of Congress subject headings. Prerequisite: Library Science 300. 1 unit.
408. **Cataloging and Classification, II.** More complex problems in making and evaluating the changing, modern library catalog; practical and administrative problems in cataloging serial publications, analytics, ephemeral materials, and microforms; deals with various nonprint media, rare books and manuscripts, foreign language materials, and materials in special subject areas. Prerequisite: Library Science 407. 1 unit.
409. **Communication Roles and Responsibilities of Libraries.** Consideration of mass media of communication in terms of their relations with modern library services; review of media organization, content, and research; consideration of problems of intellectual freedom as an aspect of communications behavior; and discussion of the potential role of electronic devices in library activities now and for the future. 1 unit.
410. **Adult Public Services.** The literature, history, and problems of providing library service to the general adult user; investigation of user characteristics and needs, and the effectiveness of various types of adult services. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
411. **Reference Service in the Humanities and Social Sciences.** Detailed consideration of the bibliographical and reference materials in various subject fields; training and practice in their use for solving questions arising in reference service. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
412. **Science Reference Materials for Specialists.** Aims (a) to acquaint students with typical reference materials in science and technology that serve the information and research needs of specialist users of academic, technical, and research libraries, and (b) to develop proficiency in their selection, evaluation, and use; centered around characteristics and information needs of library users with considerable technical backgrounds. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
415. **Library Automation.** Introduction to various types of equipment for handling information and providing services in libraries; study of applications to library operations; and introduction to systems planning, to automation concepts, and to computer use. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
416. **Advanced Library Automation.** The development of computer programs for library technical processes such as circulation, acquisitions, serials control, cataloging, and the analysis of library computer networks and data bases; includes seminar presentations based on individual research in automation topics. Prerequisite: Library Science 415. 1 unit.
424. **Government Publications.** Aims to acquaint students with government publications, their variety, interest, value, acquisition, and bibliographic control, and to develop proficiency in their reference and research use; considers publications of all types and all

governments (local, national, international) with special emphasis on U.S. state and federal governments and on the United Nations and its related specialized agencies. Prerequisite: Library Science 411, 412, or consent of instructor. 1 unit.

427. **Resources of American Research Libraries.** Acquaints students with the distribution and extent of American library resources for advanced study and research; spatial and financial aspects of library resources; methods of surveying library facilities; growth and use of union catalogs and bibliographical centers; interinstitutional agreements for specialization of collections and other forms of library cooperation; and the use of the research collection by the scientist and scholar. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
428. **Library Buildings.** Study of the library's physical plant in the light of changing concepts and patterns of library service; analysis of present-day library buildings, (both new and remodeled) and their comparison with each other as well as with buildings of the past; examination of the interrelationship of staff collections, users, and physical plant; and discussion supplemented by visits to new libraries and conference with their staffs. A two-day field trip is required; see *Timetable* for estimated cost. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
429. **Information Storage and Retrieval.** Types of systems for storage and retrieval of documents and references; history of retrieval systems, their characteristics, evaluation, and factors affecting their performance, with special reference to modern computer-based systems; procedures in the dissemination of scientific and other information; major information centers and services in the U.S. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
430. **Advanced Reference.** Enables the student to utilize the varied resources of a large research library; deals with the methods of analyzing and solving bibliographic problems such as arise in scholarly libraries and in connection with research projects. Prerequisite: Library Science 411 or 412, and consent of instructor. 1 unit.
431. **Books and Libraries in the Ancient and Medieval World.** The development of writing and of the book in ancient and medieval times; book collecting and the growth of libraries from earliest times to the discovery of printing. 1 unit.
432. **Books and Libraries Since the Renaissance.** Same as Communications 432. Study of the developing format of the book, the history of printing, and the growth of libraries in Europe and America since the Renaissance. 1 unit.
433. **Advanced Subject Bibliography.** Study of the literature, information sources, and reference aids in various specialized fields of knowledge, identified as different sections of this course, from the point of view of their use by librarians. Prerequisite: Consent of instructor. ½ unit. May be repeated for a total of 1 unit.
434. **Library Systems.** Development of library systems, with special reference to public libraries as a norm for the development of library services; detailed treatment of library standards; the growth and development of county and regional libraries, and the role of the state library and of federal legislation. Prerequisite: Library Science 405 or consent of instructor. 1 unit.
435. **Library Services to Specialist Users.** In-depth study of goals and objectives, policy, and services of research-oriented libraries; of characteristics and information needs of specialist users of these libraries; and of effective library services that satisfy specialist user needs. Study is based on actual library operations according to subject interest of student. Prerequisite: Library Science 411 or 412. 1 unit.
438. **Administration and Use of Archival Materials.** Administration of archives and historical manuscripts; emphasis on the processing and research use of archival materials. Prerequisite: Consent of instructor. 1 unit.
439. **Medical Literature and Reference Work.** Consideration of representative reference and bibliographical aids in medical sciences; problems provide experience with typical medical reference sources (only at the University of Illinois Medical Center in Chicago). Prerequisite: Consent of instructor. 1 unit. Offered in the summer session only.

440. **Advanced Bibliography.** Discusses the major reference bibliographies, including general works, subject lists in various fields, regional historical and current national bibliographies, and published library catalogs; surveys the nature of bibliographical access to the output of the world's press, descriptive bibliography, and rare-book librarianship. Prerequisite: Library Science 301 or consent of instructor. $\frac{1}{2}$ or 1 unit.
441. **History of Children's Literature.** Interpretation of children's literature from the earliest times, including the impact of changing social and cultural patterns on books for children; attention to early printers and publishers of children's books and to magazines for children. 1 unit.
442. **Seminar in Library Materials for Children and Young Adults.** Advanced study of criteria for the evaluation of books and other media, including an individual project on a given theme or subject involving extensive critical reading, viewing, and listening. Prerequisite: Library Science 303, 304, or consent of instructor. 1 unit.
443. **Contemporary Book Publishing.** Survey of twentieth-century book publishing, placing it in an economic, social, and literary context; emphasis on economic structure, the relationship of author and publisher, promotion, distribution, and the influence of the industry on librarianship. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
444. **Measurement and Evaluation of Library Services.** Methods and criteria for evaluating various facets of library service, including the collection, the catalog, document delivery capabilities, reference service, technical processes, and information retrieval operations; deals with cost-effectiveness considerations. Prerequisite: Library Science 300 or consent of instructor. 1 unit.
445. **Vocabulary Control of Information Retrieval.** The construction, characteristics, and application of controlled vocabularies for use in information retrieval systems; covers a full range of vocabulary control possibilities from highly structured thesauri and classification schemes to natural-language (free text) searching; special emphasis on the thesaurus and vocabulary control in computer-based systems. Prerequisite: Library Science 429. 1 unit.
450. **Advanced Problems in Librarianship.** Directed and supervised investigation of selected problems in library resources, reference service, research libraries, reading, public libraries, or school libraries. Prerequisite: Fifth-year degree in library science or consent of director. $\frac{1}{2}$ to 2 units.
460. **Special Topics in Librarianship.** An advanced seminar on topics of individual choice; presentation and criticism of written research reports based on individual study on an advanced level; and sections or practicum in research methods offered in the following areas: (a) historical, I; (b) survey; (c) observation; (d) experimental; and (e) historical, II. Students may enroll in a maximum of two sections, concurrently or consecutively. Open to doctoral students only. Prerequisite: Library Science 469 or consent of instructor. $\frac{1}{2}$ to 2 units.
465. **Librarianship and Society.** Analysis of the role and functions of libraries in the twentieth century; the changing characteristics of information and knowledge viewed as major determinants of libraries' relations to society. Prerequisite: M.S. in library science or consent of instructor. 1 unit.
468. **Education for Librarianship.** For those interested in preparing for teaching library science at the graduate level; analyzes current problems in library education in terms of the historical background, the current situation, and possible solutions. Prerequisite: M.S. in library science. 1 unit.
469. **Principles of Research Methods.** Designed for persons planning to engage in research; reviews significant investigations in the library field and considers the use of hypotheses, the conduct of experiments, the nature of proof, and the employment of statistical methods, with a view to helping students develop their dissertations. Required for Ph. D. candidates. Prerequisite: Knowledge of the principles of statistics; M.S. in library science or consent of instructor. 1 unit.

499. **Thesis Research.** Individual study and research. Section A: M.S. candidates, 0 to 2 units. Section B: doctoral candidates, 0 to 4 units.

LIFE SCIENCES, SCHOOL OF

(Including Biology, Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology)

School Office: 387 Morrill Hall, Urbana

Biology

100. **Biological Science, I.** Introduction to the biological sciences, their aims, content, and methods, with special reference to their application to human life and civilization. 4 hours.
101. **Biological Science, II.** Continuation of Biology 100. Prerequisite: Biology 100 or consent of instructor. 4 hours.
110. **Principles of Biology, I.** Heredity, evolution, diversity, reproduction, development, structure and function of cells, organisms, and populations. Prerequisite: One year of college chemistry, or concurrent enrollment in Chemistry 102 with laboratory. 5 hours.
111. **Principles of Biology, II.** Continuation of Biology 110. Prerequisite: Biology 110. 5 hours.
151. **The Cell.** Study of the biology of cells from the molecular to the microscopic level of organization. Prerequisite: Credit or registration in organic chemistry; consent of honors biology committee. 5 hours.
198. **Freshman Seminar.** Current topics in biology in the context of total culture. Participants are required to do independent library research and to present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 1 hour.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
208. **Investigations in Biology, I.** Provides broad exposure to research methodology in the biological sciences; includes a general introduction to experimental design and analysis, followed by individual design and completion of an experiment in genetics and evolution. Prerequisite: Biology 110 and 111, or equivalent. 4 hours.
209. **Investigations in Biology, II.** Continuation of Biology 208. Individual design and completion of experiments in development, functional anatomy, behavior, and ecology. Prerequisite: Biology 208 or consent of instructor. Students who have not had Biology 208 will enroll in special sections. 4 hours.
210. **Genetics.** Principles of heredity and the nature of genetic material. Credit is not given for both Biology 210 and Zoology 106. Prerequisite: Biology 111 or equivalent, or consent of instructor. 4 hours.
211. **Developmental Biology.** Introduction to basic mechanisms of organismic development as elucidated by descriptive and experimental methods. Prerequisite: Biology 111 or equivalent; a course in organic chemistry. 3 hours.
212. **Environmental Biology.** Lecture, discussion, laboratory, and field course dealing with the relationships between organisms and their environment; introduction to physiological bases for adaptations, population dynamics, community organization, and the structure and function of ecosystems. Prerequisite: One year of biology or consent of instructor. 5 hours.
251. **The Organism.** Study of the way different classes of organisms respond to challenges of their environment; emphasis on the general features of organismic behavior. Prerequisite:

- site: Biology 151; good standing in the honors biology program; and consent of the honors biology committee. 5 hours.
296. **Honors Seminar.** Lectures, student presentations, and discussions on selected topics of biology. Prerequisite: Junior or senior standing; 4.0 cumulative average; two courses in biology or consent of instructor. 1 hour. May be repeated once for credit.
 307. **Immunology.** Introduction to fundamentals of immunology with emphasis on biological application; basic background for understanding immunological responses and techniques applicable to biological research. Prerequisite: Four semesters of college biology; a course in organic chemistry, or consent of instructor. 4 hours or $\frac{3}{4}$ unit.
 308. **Experimental Immunobiology.** Introduction to immunological laboratory techniques for solving biological problems and to experimental techniques in cellular immunology. Prerequisite: Credit or concurrent registration in Biology 307; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
 310. **Principles of Population Biology, I.** Biology 310 and 311 provide an integrated treatment of population concepts in biology. Major topics: ecology, ethology, population genetics, and evolution. Prerequisite: Biology 210 or consent of instructor; college algebra. 3 hours or $\frac{3}{4}$ unit.
 311. **Principles of Population Biology, II.** Continuation of Biology 310. Prerequisite: Biology 310 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
 313. **Experimental Genetics.** Laboratory course to expose students to several types of organisms, experimental approaches, and methods of analysis utilized in genetical research. Prerequisite: Biology 151 or 210; consent of instructor. 4 hours or 1 unit.
 314. **Experimental Development.** Laboratory course to expose students to a variety of organisms, experimental approaches, and methods of analysis utilized in developmental research. Prerequisite: Biology 211 or 251, or Zoology 333; consent of instructor. 4 hours or 1 unit.
 316. **Population Genetics.** Same as Dairy Science 316. The mathematical theory of the genetics of populations: estimation of gene frequency, Hardy-Weinberg principle, systems of mating, relationship between relatives, and forces that change gene frequency; applications to man, animals, and plants. Students desiring 4 hours or 1 unit credit will do additional work in some area of population genetics. Prerequisite: Dairy Science 110 or Biology 210 and college algebra; or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
 338. **History of Biology.** Same as History 338. Development of biological thought from antiquity to the present, emphasizing evolutionary theory and physiology in the nineteenth century and genetics in the twentieth century. Prerequisite: One year of college biology or history, or consent of instructor. 3 hours or 1 unit.
 351. **Population Biology.** Study of problems associated with behavior of plant and animal populations based on genetic, evolutionary, and ecological principles. Prerequisite: Biology 251; statistics; good standing in the honors biology program; consent of Honors Biology Committee. 4 hours or 1 unit.
 371. **Quantitative Biology, I.** Theory and practical application in biology of probability and statistics; lectures and assigned problems. Prerequisite: College algebra; consent of instructor. 4 hours or 1 unit.
 372. **Quantitative Biology, II.** Additional statistical topics in biology, including sequential nonrandomness, nonparametric correlation, and binomial sequential sampling; limited enrollment; individual problems. Prerequisite: Biology 371 or equivalent introductory statistics course, and consent of instructor. 2 hours or $\frac{1}{2}$ unit.
 373. **Advanced Biometry.** Bivariate and multivariate statistical treatment of biological experiments and surveys; emphasizes analysis of large, unbalanced data matrices; and follows the general linear model approach. Techniques appropriate to electronic digital computation are considered in detail. Prerequisite: A course in calculus, a course in statistics, and a course or experience in electronic digital computation; or consent of instructor. 5 hours or 1 unit.
 374. **Quantitative Ethology.** Same as Zoology 374. Ethological and sociobiological applications of mathematical and statistical concepts and methods to vertebrate and inverte-

- brate behavior: analysis of ethograms; stochastic, informational, and sequential analysis of behavior; use of multidimensional contingency tables in the study of social interactions; mathematical models: evolution of cooperative behavior via individual, kin, and group selection; animal conflict; and animal play. Prerequisite: Zoology 346 or Psychology 345; elementary statistics or probability. 3 hours or $\frac{3}{4}$ unit.
380. **Social Issues in Biology.** Ethical and sociopolitical implications of the biological sciences; an issue-oriented lecture-discussion format centering on problems such as bioethics, genetics and development, health care and allocation of scarce resources, death and dying, behavior manipulation, biological experimentation, population control, and environmental ethics. Prerequisite: Upper-division standing and 6 hours of life science. 3 hours or $\frac{3}{4}$ unit.
411. **Discussions in Genetics and Cytogenetics.** $\frac{1}{4}$ unit.
416. **Quantitative Genetics.** Same as Dairy Science 416. The mathematical theory of the genetics of quantitative traits: properties of random-mating populations; estimation of repeatability, heritability, and genetic correlation; genetic results of selection; aids to selection; correlated response; selection for more than one trait; and applications to animals and plants. Prerequisite: Dairy Science 316 and 340, or consent of instructor. 1 unit.
418. **Concepts and Topics in Immunology.** Same as Veterinary Medical Science 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunologic tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor; Microbiology 327 and Biology 307 recommended. $\frac{1}{2}$ unit.
423. **Electron Microscopy.** Same as Chemistry 423. Lectures, discussions, and demonstrations on the physical principles and electron optics of the transmission electron microscope and its modern variants; lectures and demonstrations of modern high vacuum techniques. Open to qualified graduate students in all departments. Prerequisite: A course in modern physics or physical chemistry (having calculus as a prerequisite) affording an introduction to wave mechanics; consent of instructor. $\frac{1}{2}$ unit.
429. **Electron Microscopy with Laboratory.** Same as Chemistry 429. General lectures on theory and design of electron microscopes without mathematical derivations; discussion and practice on specimen preparation; operation of electron microscopes with separate sections to meet special needs of biologists, geologists, and those interested in electron diffraction. Most theory lectures may be omitted by those concurrently enrolled or having credit in Biology 423 or Chemistry 423. Open to qualified graduate students in all departments. Prerequisite: Two semesters of general physics; two semesters of college mathematics; three semesters of chemistry; consent of instructor. 1 unit.
430. **Biological Ultrastructure.** Lectures and reports on the fine structure of plant and animal cells and cell products; discussions of possible relationships of ultrastructure to function and of diverse interpretations of chemical-physical information as ultrastructure. Prerequisite: Consent of instructor. 1 unit. Offered in 1975-76 and in alternate years.
431. **Plant Cell Metabolism.** Same as Agronomy, Forestry, Horticulture, and Plant Pathology 431. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the biochemistry of mature seeds and metabolic processes occurring during seed germination and heterotrophic growth. Meets during the first half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
432. **Plant Cell Energetics.** Same as Agronomy, Forestry, Horticulture, and Plant Pathology 432. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the energy coupling processes in plant cells (respiration, photosynthesis, photorespiration); and discusses current literature relating to mechanisms of electron transport, phosphorylation, and carbon fixation. Meets during the

second half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.

- 433. Environmental Regulation of Plant Growth.** Same as Agronomy, Forestry, Horticulture, and Plant Pathology 433. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns mechanisms of plant response to the environment, including ion uptake and transport, water relationships, gas exchange, and photosynthesis of whole plants. Meets during the first half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 434. Regulation of Plant Development and Reproduction.** Same as Agronomy, Forestry, Horticulture, and Plant Pathology 434. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the hormonal regulation of growth, development, and reproduction and the metabolism of seed and fruit formation. Meets during the second half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 450. Ecological Methods, I.** Field and laboratory methods employed in ecological research. First semester of a two-semester sequence; covers methods involved in studying physical and chemical properties of soil, soil organisms, and measuring physical environmental factors. Prerequisite: A course in statistics; consent of instructor. 1 unit.
- 451. Ecological Methods, II.** Field and laboratory methods employed in ecological research. Second semester of a two-semester sequence; covers sampling of populations and communities, and analysis of ecosystem functions. Prerequisite: Biology 450; consent of instructor. 1 unit.
- 452. Ecology Seminar.** Discussion, review, and critical analysis of specific topics in ecology; required of all students in the ecology program. Prerequisite: Two courses in ecology; consent of instructor. $\frac{1}{4}$ unit. May be repeated to a total of 2 units.
- 453. Analysis of Ecosystems.** Practical application of statistical techniques and computer technology to ecological problems; emphasis on model building for analysis of population dynamics, and structure and function of ecosystems; and individual problems. Prerequisite: Botany 381, Zoology 345 or Entomology 315, Biology 310 and 371, Mathematics 120, and Computer Science 121, or consent of instructor. 1 unit. Offered in 1974-75 and in alternate years.
- 457. Ultrastructural Pathology.** Same as Veterinary Medical Sciences 457. Ultrastructural basis of pathologic processes occurring in animal tissues and cells; lectures, discussions and reports. Prerequisite: Consent of instructor. $\frac{3}{4}$ or 1 unit.
- 475. College Biology Teaching Seminar.** Seminar in the teaching of biology for prospective college teachers. A second $\frac{1}{4}$ unit can be earned by completion of a project in an approved topic area. Prerequisite: Graduate standing in a program within the School of Life Sciences. $\frac{1}{4}$ to $\frac{1}{2}$ unit.
- 490. Special Topics in Biology.** Individual topics in research and/or reading conducted under the supervision of faculty members in the School of Life Sciences. Designed for students enrolled in the biology program who would like to become more familiar with specialized fields of study prior to committing themselves to a specific area for their doctorate degree. $\frac{1}{2}$ to 2 units.
- 493. Advanced Electron Microscopy.** Same as Chemistry 493. Conferences and practice dealing with specialized laboratory techniques, preparation of specimens, and the analysis and study of varied materials by use of transmission and/or scanning electron microscopes, and by the techniques of electron diffraction. Open to qualified students in all departments. Prerequisite: Biology 429; consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.
- 499. Thesis Research.** 0 to 4 units.

Botany

Head of Department: Professor J. B. Hanson

Department Office: 289 Morrill Hall, Urbana

100. **General Botany.** Basic principles of growth and form, physiology, genetics, evolution, and ecology in plant biology. Students may not receive credit for both Botany 100 and 101. 4 hours.
101. **General Botany for Selected Students.** Provides instruction in the structure, physiology, reproduction, ecology, and economic importance of plants; instruction adjusted to the level of the selected student and consists of demonstration, discussion, and lecture. Admission to each section is limited to fifteen students. Students may not receive credit for both Botany 101 and 100. Prerequisite: James Scholar standing or consent of instructor. 5 hours.
204. **Natural History of Plants.** Diversification and distribution of plants in time, space, and culture; evolution and dispersion of plants in nature and under the influence of selection and utilization by man; natural and artificial selection of important plant types and structures; and plant geography as determined by climate, geology, and cultivation. Prerequisite: Botany 100 or 101, or equivalent. 3 hours.
220. **Evolutionary Survey of the Plant Kingdom.** The morphology and evolution of plants representative of algae, fungi, liverworts, mosses, lower vascular plants, and seed plants. Prerequisite: Botany 100 or 101, or Biology 110 and 111. 3 hours.
234. **Form and Function in Flowering Plants.** Lecture course on the physiological and morphological attributes that underlie the biosynthesis, growth, and reproduction of flowering plants in relation to the environment. Prerequisite: Botany 100 or 101, or a year of biology; Chemistry 102. 3 hours.
260. **Introductory Plant Taxonomy.** Classification and identification of flowering plants, with special reference to the local flora and to the needs of high school teachers. Occasional field trips required. Prerequisite: Botany 100 or 101, or Biology 100 and 101, or Biology 111. 3 hours.
290. **Individual Topics.** For seniors who wish to study individual problems and topics not assigned in other courses. Prerequisite: Ten hours of advanced work in botany or another biological science: senior standing. 2 to 5 hours. May be repeated for a maximum of 5 hours.
292. **Senior Thesis.** Independent research for seniors in botany; prerequisite for graduation with distinction in botany and recommended for students intending graduate study. A thesis must be submitted for credit to be received, but graduation with distinction is not an automatic result of enrollment in Botany 292. Will substitute for Botany 290 in fulfilling independent study requirement. Prerequisite: Candidacy for degree with distinction in botany. 2 to 5 hours. May be repeated for a maximum of 10 hours.
304. **General Plant Morphology.** Lecture and laboratory course dealing with the structure, reproduction, and evolution of representative algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms. Prerequisite: Botany 100, Biology 101, 111, 251, or consent of instructor. 4 hours or 1 unit.
325. **Paleobotany.** Same as Geology 325. Structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. Prerequisite: Botany 100, or Biology 100 and 101; Geology 101 or 107; or consent of instructor. 5 hours or 1 unit.
330. **Plant Physiology.** General course concerned with plant functions, including water relations, mineral nutrition, metabolism, growth, and reproduction. Prerequisite: Chemistry 131; Botany 100, or Biology 101, 111, or 251. 3 hours or ½ unit.
331. **Experimental Cytology.** Same as Zoology 331. Lectures on structure and function of the cell; coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or 251; consent of instructor. 3 hours or ¾ unit.

- 333. Plant Physiology Laboratory.** Same as Agronomy 333 and Horticulture 333. A laboratory course in plant physiology; a supplement to Botany 330 which serves the needs of those interested in acquiring familiarity with techniques of experimental plant physiology. Prerequisite: Credit or concurrent registration in Botany 330 or equivalent. 4 hours or 1 unit.
- 334. Experimental Cytology Laboratory.** Same as Zoology 334. Introduction to cytological techniques, microscopic analysis of macromolecules, isotopic techniques, and autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 341. Field Ecology.** Study of plant communities in various sections of North America during spring vacation. Trips rotate on a three- to five-year basis. Outdoor cooking and camping; transportation in University cars. Prerequisite: One of the following: Botany 260, 366, 381, or 385; consent of instructor. 1 hour or $\frac{1}{4}$ unit. May be repeated for a maximum of 3 hours or $\frac{3}{4}$ unit.
- 345. Plant Anatomy.** Study of the internal structure of vascular plants with special emphasis on development, function, and evolutionary history. Prerequisite: One year of botany. 4 hours or 1 unit.
- 350. Phycology.** Introductory lecture and laboratory to the ecology, morphology, physiology, and systematics of the algae. Prerequisite: One year of botany or another biological science, or consent of instructor. 4 hours or 1 unit.
- 351. Viruses, I.** Same as Microbiology and Zoology 351. An introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200, or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.
- 360. Angiosperm Phylogeny and Biogeography.** The phylogeny of the angiosperms and their past and present geographic distribution as reflected in the major floras of the world. Prerequisite: Botany 260 or consent of instructor. 4 hours or 1 unit.
- 363. Plant Products.** Lectures on the natural products of plants, with emphasis on relevant compounds of ecological, pharmacological, toxicological, and economic interest. Prerequisite: Biochemistry 350 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 366. Field Botany.** Identification and classification of native and naturalized flowering plants of eastern North America. Prerequisite: One course in botany; consent of instructor. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. Offered in the summer session only.
- 372. General Mycology.** Structure, classification, and identification of fungi, including those of economic importance. Prerequisite: One year of botany, entomology, microbiology, or zoology; senior standing or consent of instructor. 4 hours or 1 unit.
- 381. Plant Ecology.** Principles of ecology exemplified by vegetation and environments of Illinois. Prerequisite: Botany 260 or equivalent. 5 hours or 1 unit.
- 382. Aquatic Plant Ecology.** Ecology of plant communities in freshwater, estuarine, and marine ecosystems; lecture, laboratory, and field work. Prerequisite: Botany 100 or 101, Biology 110 and 111 or equivalent, or consent of instructor. 5 hours or 1 unit.
- 402. Molecular Genetics: Chromosome Mechanics.** Same as Microbiology and Zoology 402. Structure and behavior of chromosomes (including replication, repair, complementation, recombination, and mutation); emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or consent of instructor. $\frac{3}{4}$ unit.
- 403. Physiology of Fungi.** Same as Plant Pathology 403. Germination, growth, metabolism, and sporulation of fungi; physiology of fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products; and discussion of the nature of fungicidal activity. Prerequisite: Organic chemistry or biochemistry; mycology; Plant Pathology 204 or equivalent; microbiology. 1 unit. Offered in alternate years.
- 405. Molecular Genetics: Gene Action.** Same as Microbiology and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with intracellular transmission of genetic information; gene regulation, transcription, and translation. Prere-

quisite: Microbiology 330, Microbiology 316 plus biochemistry, or consent of instructor. $\frac{3}{4}$ unit.

410. **Botany Discussions.** All graduate students in botany, except those with conflicting teaching assignments, are required to register in and attend the general seminar. No credit given except to those students presenting the results of their Ph.D. thesis research. 0 or $\frac{1}{4}$ unit.
413. **Discussions in Plant Physiology.** $\frac{1}{4}$ unit.
414. **Discussions in Plant Morphology and Taxonomy.** $\frac{1}{4}$ unit.
418. **Discussions in Plant Ecology and Plant Geography.** Developments in ecology and plant geography, with emphasis on one special division. Prerequisite: Graduate standing in botany, entomology, geography, or zoology. $\frac{1}{4}$ unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.
419. **Discussions in Photosynthesis and Related Topics.** Prerequisite: Consent of instructor. Students may accumulate 1 $\frac{1}{2}$ units. 0 or $\frac{1}{4}$ unit.
421. **Cytogenetics.** Same as Zoology 421. Chromosome theory: structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210 or Microbiology 330, or consent of instructor. 1 unit.
424. **Mineral Nutrition of Plants.** Same as Agronomy 424 and Horticulture 424. Study of uptake, transport, and metabolic utilization of mineral nutrients by plants. The scope of the course is to present the essentiality of various anions and cations in light of metabolic activity and constituency in functional plant compounds; major emphasis on metabolic activity and function of the elements. Prerequisite: Botany 330 or consent of instructor. 1 unit.
427. **Discussions in Mycology.** Seminar course designed for discussion of current research in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit.
438. **Bioenergetics of Photosynthesis.** Same as Biophysics 438. Biophysical and biochemical mechanisms of green plant and bacterial photosynthesis; includes the role of membranes; and emphasizes energetic aspects of photosynthesis. Meets during the first half of the spring semester. Prerequisite: One year each of college physics, chemistry, and biology; Biochemistry 350 or Biophysics 301; or consent of instructor. $\frac{1}{2}$ unit.
442. **Environmental Plant Physiology.** Same as Agronomy 442. Lecture course dealing with the interaction of plants and environment at the level of the whole organism, extending to the cell and the community; emphasis on heat and mass transfer, plant and soil potentials, and effects of light on growth. Prerequisite: Chemistry 131; general physics; general or plant physiology; consent of instructor. 1 unit.
461. **Angiosperm Systematics.** An integrated approach to the uses of systematic data from genetics and cytogenetics, chemistry, anatomy-morphology, and ecology, and their application to problems in angiosperm classification and phylogeny. Prerequisite: Botany 260 or consent of instructor. 1 unit. Offered in alternate years.
462. **Origin of Variation in Plants.** Same as Agronomy 462. Study of the principles of plant evolution; discussion of theoretical and descriptive aspects of origin of variation, mode of speciation, role of hybridization, natural and artificial selection, and adaptation. Prerequisite: Consent of instructor. 1 unit.
471. **Advanced Mycology: Special Groups.** The several classes of fungi and their activities are considered in successive semesters. Special groups within these classes may be selected for concentrated study, depending upon the student's interest in mycology. Prerequisite: Botany 372 or consent of instructor. $\frac{1}{2}$ unit.
485. **Plant Geography of North America.** Study of principles of plant geography, plant distribution in relation to environment, and vegetational units of North America. Prerequisite: Botany 381 or equivalent. 1 unit. Offered in alternate years.
488. **Plant Pigments.** Same as Horticulture 488. A comprehensive presentation of the nature, function, distribution, biosynthesis, degradation, separation, and spectroscopic properties of pyrrole, carotenoid, quinone, and anthocyanin pigments. Prerequisite: Botany 330 or consent of instructor. 1 unit. Offered in alternate years.

490. **Advanced Studies in Botany.** Not more than 1 unit may be applied toward the Graduate College master's degree requirement of 3 units of course work at the 400 level. Work may be taken in the following areas: (a) anatomy; (b) biochemical cytology; (c) biological rhythms; (d) cytogenetics and speciation; (e) ecology; (f) genetics; (g) morphogenesis and development; (h) morphology; (i) mycology; (j) paleobotany; (k) photosynthesis; (l) phycology; (m) physiology; (n) taxonomy; (o) ultrastructure; and (p) virology. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** Individual work under supervision of members of the staff in their respective fields. 0 to 4 units.

Entomology

Head of Department: Professor S. Friedman

Department Office: 320 Morrill Hall, Urbana

101. **Agricultural Entomology.** Lectures and discussion with laboratory practice in the recognition of agricultural pests for students of agriculture; covers methods of injury by insects; their structure, physiology, metamorphosis, classification, and control; recognition, nature of injury, life history, and habits; and control of the more common destructive or annoying pests of field crops, vegetables, fruits, stored products, and domestic animals. Counts for credit in technical agriculture. 3 hours.
103. **Life of Insects.** Nontechnical course designed to give a balanced comprehensive picture of insect life; treats insect structures, growth, and relationships with other animal groups; life histories of the principal groups; modes of reproduction, movement, protection, communication, and behavior; interrelations with the physical and biotic environment, parasitism, transmission of diseases, predatism, and pollination; and includes how insects benefit and injure man, their control, and their roles in the history of man and in the arts. Credit is not given for both Entomology 103 and 118. 4 hours.
118. **Insects, Man, and Environment.** Nontechnical course which considers basic aspects of entomology and ecology, especially as they relate to problems in the use of pesticides and environmental pollution. Credit is not given for both Entomology 118 and 103. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
290. **Special Problems.** For students ready to undertake special investigation to be completed as an undergraduate study or as the beginning of a thesis problem for an advanced degree. It also may be used to prepare a thesis for scholastic honors. Prerequisite: Consent of instructor. May be taken by students who can only attend classes on Saturday morning. 2 to 5 hours.
301. **Introduction to Entomology.** Integrated studies of the principal morphological, physiological, and ecological relationships of insects. Prerequisite: Biology 111; Chemistry 131; consent of instructor. 5 hours or 1 unit.
302. **Classification of Insects.** Comprehensive survey of the systematics and phylogeny of the orders and principal families of insects, with practical experience in identification of these taxa. Prerequisite: Consent of instructor. 4 hours or 1 unit.
312. **Entomology for Teachers.** Recognition of the chief orders of insects in their immature and adult stages, including their development, life cycles, and interrelationships with the environment; students will prepare collections; field trips, laboratory, and discussion. Prerequisite: One year of biology, botany, zoology, or equivalent. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. Offered in the summer session only.
315. **Insect Ecology.** Discussion of the practical and theoretical aspects of ecology in relation to insects as individuals, populations, and communities; emphasis on the role of insects in the environment. Prerequisite: Biology 212 or consent of instructor. 4 hours or 1 unit.

319. **Fundamentals of Insect Control.** Emphasis on the principles underlying control of important insect pests of agriculture and human and animal health; study of integrated pest control involving biological, cultural, and chemical factors and of the ecology of the use of pesticides in the total environment. Prerequisite: Biology 111 and Chemistry 101, or equivalent; consent of instructor. 4 hours or 1 unit.
322. **Insect Bionomics.** Biology of insects dealing with life history and conditions of environment that favor abundance of insects representative of various habitats. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 4 hours or 1 unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Horticulture 361 and Zoology 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or ½ unit.
410. **Insect Morphology.** Comprehensive study of internal and external structures of insects from the comparative viewpoint. Prerequisite: Biology 111 or equivalent; consent of instructor. 1 unit.
413. **Medical and Veterinary Entomology.** Training in recognition, classification, methods of injury, habits, and control or destruction of insects, mites, and ticks which are predators, parasites, or disseminators of disease among men and domestic animals. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 1 unit.
420. **Chemistry and Toxicology of Insecticides.** Designed to provide fundamental information concerning the mode of action, the relationship of chemical structure to toxicity, and the physiological explanation of the chemical poisoning of insects. Prerequisite: One year of biology or equivalent in animal science; organic chemistry; consent of instructor. 1 unit.
422. **Insect Physiology.** Study of principal physiological and biochemical functions of insects, exclusive of sensory functions. Prerequisite: Entomology 302 and 410; organic chemistry; consent of instructor. 1 unit.
423. **Insect Behavior and Its Physiological Basis.** Insect locomotion, feeding, reproduction, defensive reactions, learning, and other behavior, and the physiological basis of these activities. Prerequisite: Entomology 422 or Physiology 301, or consent of instructor. ¾ unit.
424. **Advanced Insect Physiology.** Comprehensive study of physiological and biochemical interactions between the insect and its environment including sensory mechanisms, attractants and repellants, nutritional specialization, intermediary metabolism, energy production and utilization, metabolic activity accompanying functional changes, and process controls. Prerequisite: Entomology 422; Biochemistry 350; consent of instructor. ¼ to 1 unit.
426. **Seminar in Entomology.** Discussions, reviews, and appraisals of special topics in the field of entomology. Prerequisite: Consent of instructor. 0 or ¼ unit. May be repeated for a maximum of 1 unit.
490. **Individual Topics.** Individual topics in research and/or reading conducted under the supervision of faculty members in the Department of Entomology; particularly designed for students enrolled in the entomology programs who would like to become more familiar with specialized fields of study prior to committing themselves to a specific area for their doctorate degree. Prerequisite: Consent of instructor. ½ to 2 units. May be repeated.
499. **Thesis Research.** Work may be taken in the following subjects: morphology and embryology of insects; applied entomology; systematic entomology; biology and ecology of insects; insect toxicology; and insect physiology. 0 to 4 units.

Microbiology

Head of Department: Professor R. D. DeMoss

Department Office: 131 Burrill Hall, Urbana

100. **Introductory Microbiology.** Introduction to the principal activities and properties of microorganisms, including bacteria, yeasts, molds, and viruses; consideration of the role of natural processes, such as photosynthesis; and man's use and control of microorganisms in the production of antibiotics and vaccines in industrial fermentations, in sanitation and public health, and in agriculture. Credit is not given for more than one of the following: Microbiology 100, 113, or 200. 3 hours.
101. **Introductory Experimental Microbiology.** Laboratory introduction to the techniques employed in the investigation of microbial activities and properties; experiments designed to familiarize the student with the handling, identification, and characterization of microorganisms and their activities, particularly those of interest to man. Credit is not given for both Microbiology 101 and 201. The course terminates at mid-semester. Prerequisite: Credit or concurrent registration in Microbiology 100. 2 hours.
113. **Man and Microbes.** General education biological science course for nonscience majors; examines the effects of microbes on the activities of man; emphasizes environmental, economic, and disease effects of microbial activity on society; and presents microbiology as an example of a modern biological science. Credit is not given for more than one of the following: Microbiology 113, 200, or 100. 3 hours.
200. **Microbiology.** Emphasis on fundamental concepts of microbiology, including nutrition, ecology, and physiology of microorganisms, and their role in nature and in infection and immunity. Credit is not given for more than one of the following: Microbiology 200, 100, or 113. Prerequisite: Credit or concurrent registration in organic chemistry. 3 hours.
201. **Experimental Microbiology.** Laboratory emphasizing the fundamentals of microbiology, including the biochemical basis of microbial physiology, ecology, and nutrition; microbial genetics and gene-enzyme relationships. Emphasis and encouragement are given to the experimental approach to microbiology. Credit is not given for both Microbiology 201 and 101. Prerequisite: Credit or concurrent registration in Microbiology 200 and in organic chemistry. 3 to 5 hours.
290. **Research and Special Problems.** Prerequisite: Fifteen hours of microbiology; consent of instructor. 3 to 5 hours. May be repeated for a maximum of 10 hours.
292. **Senior Thesis.** Research under the direction of a senior staff member in microbiology. Normally, the student takes two semesters of Microbiology 292 in the senior year. Recommended for all those planning future research and graduate study; prerequisite for graduation with distinction in microbiology. In the semester preceding initial enrollment, interested students should consult with their advisors concerning the procedures for enrollment. A minimum of 2 hours per senior semester is required, and a thesis must be presented for credit to be received, but graduation with distinction is not an automatic result of enrollment in Microbiology 292. Prerequisite: Consent of senior thesis adviser. 2 to 6 hours. May be repeated for a maximum of 10 hours.
309. **Comparative Microbial Chemistry.** Emphasis on comparative biochemical activity and other chemical characteristics as a basis for discussion of the features of major groups of microorganisms; stress on comparison of the energy metabolism of microbial groups. Prerequisite: Biochemistry 350 or equivalent. 2 hours or $\frac{1}{2}$ unit.
311. **Food and Industrial Microbiology.** Relationship of microorganisms to food manufacture and preservation, to industrial fermentation and processing, and to sanitation. Prerequisite: Microbiology 101, 201, or 309, or equivalent; credit or concurrent registration in organic chemistry laboratory, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
312. **Techniques of Applied Microbiology.** Consideration, through experimentation, of properties of bacteria, yeasts, molds, and actinomycetes important to industrial process-

- es; exploration of methods of control of microbial processes in industry and sanitation. Prerequisite: Credit or concurrent registration in Microbiology 311. 2 hours or $\frac{1}{2}$ unit.
316. **Genetic Analysis of Microorganisms.** Prokaryotic and eukaryotic microbial genetic systems; emphasis on typical data analyses, together with the basic classes of genetic phenomena. Prerequisite: General genetics, Microbiology 200, or Microbiology 330. 3 hours or $\frac{3}{4}$ unit.
326. **Pathogenic Bacteriology.** Study of parasitism and pathogenic microorganisms; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, and methods of differentiation and recognition; and diseases microorganisms cause. Lectures and laboratory. Prerequisite: Microbiology 101, 201, or 309; organic chemistry laboratory. 5 hours or 1 unit.
327. **Immunology.** Survey of the field of immunology with emphasis on its chemical aspects. Lectures and laboratory. Prerequisite: Credit or concurrent registration in biochemistry, or consent of instructor. 5 hours or 1 unit.
330. **Molecular Biology of Microorganisms.** Modern contributions to the science of microbiology; emphasis on the structure, function, and synthesis of informational macromolecules and on the role microorganisms have played in molecular biology. Prerequisite: Microbiology 200 or equivalent; credit or concurrent registration in biochemistry. 3 hours or $\frac{3}{4}$ unit.
331. **Microbial Physiology and Anatomy.** Discussions and problems concerning growth, physiology, anatomy, and death of microorganisms. Prerequisite: Microbiology 200 or equivalent; Biochemistry 350 or equivalent. 3 hours or $\frac{3}{4}$ unit.
336. **Mechanisms of Pathogenesis.** The dynamic interactions between microbial parasites and their hosts; ranges from clinical to molecular aspects of infectious disease; and emphasizes established and potential mechanisms of pathogenesis. Prerequisite: Microbiology 326 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
351. **Viruses, I.** Same as Botany and Zoology 351. An introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200, or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.
402. **Molecular Genetics: Chromosome Mechanics.** Same as Botany and Zoology 402. Structure and behavior of chromosomes (including replication, repair, complementation, recombination, and mutation) with emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or consent of instructor. $\frac{3}{4}$ unit.
405. **Molecular Genetics: Gene Action.** Same as Botany and Zoology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, including gene regulation, transcription, and translation. Prerequisite: Microbiology 330, Microbiology 316 plus biochemistry, or consent of instructor. $\frac{3}{4}$ unit.
409. **Cultivation and Properties of Microorganisms.** Nutritional and metabolic properties of the major groups of microorganisms; a comparative study of the ecology, selective isolation, and cultivation of bacteria. Laboratory. Prerequisite: Biochemistry 355 or equivalent; credit or concurrent registration in Microbiology 309; consent of instructor. 1 unit.
412. **Advances in Microbiology.** Discussions of current research in the following areas of microbiology: (a) general microbiology; (b) microbial physiology and metabolism; (c) immunochemistry; and (d) molecular genetics. Prerequisite: Consent of instructor. $\frac{1}{4}$ unit. May be repeated for a maximum of 1 unit.
419. **Animal Virology.** Same as Veterinary Medical Science 419. Discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327, or Veterinary Pathology and Hygiene 331 and 332; Biochemistry 350 or 354; consent of instructor. $\frac{3}{4}$ unit.
451. **Experimental Virology.** Experiments on the biology, replication, and genetics of bacte-

riophages, with emphasis on experimental design by the student. Prerequisite: Microbiology 351; consent of instructor. 1 unit.

490. **Individual Problems.** Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.

495. **Seminar.** Required of all graduate students whose major is microbiology. Prerequisite: Ten hours of microbiology; consent of instructor. 0 or $\frac{1}{4}$ unit.

499. **Thesis Research.** 0 to 4 units.

Physiology and Biophysics

Head of Department: Professor W. W. Sleator

Department Office: 524 Burrill Hall, Urbana

BIOPHYSICS

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.

290. **Reading and Individual Topics.** Reading or laboratory work chosen in consultation with a departmental faculty sponsor. Prerequisite: Consent of instructor. 2 to 4 hours. May be repeated to a maximum of 10 hours.

301. **Introduction to Biophysics.** Review of the field of biophysics designed to introduce the student to types of biological problems currently under investigation. Prerequisite: Eight hours of physics. 3 hours or $\frac{3}{4}$ unit.

302. **Fundamentals of Nervous Activity.** The quantitative basis of the generation and transmission of electrical signals within and between nerve cells; develops and discusses, with examples, the physical relationships describing resting potential, core conduction, excitation, and synaptic transmission. Meets during the first half of the fall semester. Prerequisite: One year of calculus and one year of college physics. 2 hours or $\frac{1}{2}$ unit.

312. **Introduction to Radiobiology.** Nature and mechanisms of the biological consequences of low dose and chronic irradiation. Intended primarily for students in engineering and physical sciences. Prerequisite: Mathematics 141, or 140 and 145; 8 hours of physics; consent of instructor. 2 hours or $\frac{1}{2}$ unit.

404. **Physiological Measurements.** Same as Physiology 404. Laboratories concerned with introducing at a graduate level current research techniques in physiological and biophysical sciences; problem-oriented laboratories; students select up to four special topics representing different areas of physiology and biophysics, such as mammalian and human, molecular, cellular and radiation biology, comparative physiology, and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.

406. **Principles of Biophysical Measurements.** Lecture course designed to acquaint the student with physical methods useful in the solution of biological problems; topics covered include bioelectric measurements, including basic electronics; optical methods, including microscopy, spectrophotometry, and measurement of action spectra; use of high-energy radiations; tracer techniques; and acoustical techniques. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.

410. **Special Topics in Biophysics.** Advanced course on some topic of interest in biophysics, such as electrobiology, radiation biology, photobiology, bioacoustics, or the physics of muscular contraction. $\frac{1}{2}$ to 1 unit.

411. **Seminar.** Survey of literature in one area of biophysics, with special emphasis on student reports. Prerequisite: Enrollment in the biophysics program or consent of instructor. $\frac{1}{2}$ unit.

413. **Membrane Biophysics.** Equations for the transport of water, ions, and non-electrolytes across membranes; meets during the second half of the fall semester. Prerequisite:

- Credit or concurrent registration in Physiology 403b; one year of physics beyond introductory physics, or equivalent; physical chemistry; consent of instructor. $\frac{1}{2}$ unit.
414. **Sensory Biophysics.** Advanced treatment of sensory systems which are approachable in detailed quantitative terms, with emphasis on the visual system; lectures scheduled during the first quarter of the spring semester. Normally carries $\frac{1}{4}$ unit credit; however, students may develop a particular topic introduced in the lectures into a term paper for an extra $\frac{1}{4}$ unit credit. Prerequisite: Biophysics 301, Physiology 301 or 403, or consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit. Students must see the instructor before enrolling for $\frac{1}{2}$ unit.
 415. **Radiation Biophysics.** Consideration in quantitative terms of the mechanisms of the responses of molecules and cells to ionizing radiation; meets during the second quarter of the spring semester. Prerequisite: Graduate standing in biophysics, one year of physics beyond introductory physics and Biophysics 301 or 312, or consent of instructor. $\frac{1}{4}$ unit.
 424. **Ultrasonic Biophysics.** Same as Bioengineering 424. Ultrasonic propagation in, and interaction with, biological media at macromolecular, cellular, and organismic levels of structure; meets during the first quarter of the spring semester in alternate years. Prerequisite: Graduate standing in biophysics or consent of instructor. $\frac{1}{4}$ unit.
 426. **Kinetic Models in Biophysics.** Techniques of constructing kinetic models to correlate data from biological systems; includes drawing implications of physical mechanisms from model behavior; and considers intensive treatment of excitable cell membrane as an example of a modelled system. Meets during the second half of the spring semester in alternate years. Prerequisite: Cellular physiology and calculus. $\frac{1}{2}$ unit.
 427. **Analysis of the Excitation Process.** Analysis of the excitation process in nerve and muscle, including transport equations, ion selectivity, ion gating, and charged surface phenomena; meets during the first half of the spring semester in alternate years. Prerequisite: Biophysics 302. $\frac{1}{2}$ unit.
 428. **Cell Membranes.** Isolation and biochemical analysis; experimental membrane models Gouy-Chapman-Stern layers; equations of transport (diffusional, mediated, and active); phospholipid bilayers and protein subunits; and cell membrane synthesis (*in vivo* and *in vitro*). Meets during the second half of the spring semester in alternate years. Prerequisite: Biophysics 301 or Physiology 402; Biochemistry 350 or equivalent. $\frac{1}{2}$ unit.
 438. **Bioenergetics of Photosynthesis.** Same as Botany 438. Biophysical and biochemical mechanisms of green plant and bacterial photosynthesis; includes the role of membranes; and emphasizes energetic aspects of photosynthesis. Meets during the first half of the spring semester. Prerequisite: One year each of college physics, chemistry, and biology; Biochemistry 350 or Biophysics 301; or consent of instructor. $\frac{1}{2}$ unit.
 463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Veterinary Medical Science 463 and Animal Science 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, and biology, and/or consent of instructor. 1 unit.
 475. **Biophysics of Muscle.** Description and analysis of the fundamental physical processes underlying motility and contraction in living systems; surveys recent advances and assesses current status of relevant problems; meets during the second quarter of the spring semester in alternate years. Prerequisite: Chemistry 340 or 342, and Biochemistry 350. $\frac{1}{4}$ unit.
 490. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
 499. **Thesis Research.** Research may be conducted in one of the areas listed below, subject to approval of the staff member concerned and the department in which the research is to be done: (a) bioacoustics; (b) biophysics of excitable membranes; (c) physical properties of lipids and membranes; (d) lipid biophysics, model membranes, and pollution effects; (e) photobiology and photosynthesis; (f) biophysics of muscular contraction; (g) radiobiology; (h) information theory and cybernetics; (i) ion transport and permeability; (j) mechanical properties of tissues; (k) biophysical chemistry; (l) sensory biophysics. 0 to 4 units.

PHYSIOLOGY

101. **Introduction to Human Physiology: Physical and Chemical Bases of Cell Function, Principles of Physiological Control Systems, Coordinated Body Functions.** Emphasizes those aspects especially illustrative of general principles of biology; designed to be one-half of a student's life sciences general education requirement; especially suitable for coupling with an anthropology or psychology course. Prerequisite: High school chemistry strongly recommended. 3 hours. Credit will not be given for Physiology 101 and any of the following: Physiology 102, 103, 104, 105, or 106.
102. **Introduction to Human Physiology: Principles of Physiological Control Systems, Coordinated Body Functions, Physiological Bases of Behavior.** Emphasizes those aspects which make physiology unique among the life sciences; designed to be one-half of a student's life sciences general education requirement; especially suited for coupling with another course in biology. Prerequisite: A college course in biology or equivalent (for example, 3 hours credit or credit waiver via CLEP examination). 3 hours. Credit will not be given for Physiology 102 and any of the following: Physiology 101, 103, 105, 106, or 107.
103. **Introduction to Human Physiology: The Physical and Chemical Bases of Cellular Function, Principles of Physiological Control Systems, Coordinated Body Functions, Physiological Bases of Behavior.** Prerequisite: High school chemistry strongly recommended. 4 hours. Credit will not be given for Physiology 103 and any of the following: Physiology 101, 102, 104, 105, 106, or 107.
104. **Physical and Chemical Bases of Cell Function: Scientific Method, Nature of Biological Systems, Cell Metabolism, Heredity.** Prerequisite: High school chemistry strongly recommended. 1 hour. Credit is not given for Physiology 104 and any of the following: Physiology 101 or 103.
105. **Principles of Physiological Control Systems: Nature of Nerve Impulse, Neural and Hormonal Control Mechanisms, Homeostatic Mechanisms.** Prerequisite: Either (a) credit or concurrent registration in Physiology 104, or (b) a college life science course, or (c) 3 hours credit or credit waiver via CLEP examination. 1 hour. Credit will not be given for Physiology 105 and any of the following: Physiology 101, 102, or 103.
106. **Coordinated Body Functions.** Study of the cardiovascular, renal, respiratory, and digestive systems. Prerequisite: Credit or concurrent registration in Physiology 105. 1 hour. Credit will not be given for Physiology 106 and any of the following: Physiology 101, 102, or 103.
107. **Physiological Bases of Behavior.** Processing of sensory information; physiological correlates of consciousness and behavior; motor control; and reproduction and sex. Prerequisite: Credit or concurrent registration in Physiology 101 or 106. 1 hour. Credit will not be given for Physiology 107 and any of the following: Physiology 102 or 103.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
234. **Human Anatomy and Physiology.** Study of the essentials of anatomy and physiology with special reference to muscular and nervous systems. Prerequisite: Physiology 103 or consent of instructor. 5 hours.
290. **Reading and Individual Topics Course.** Readings or laboratory work in fields chosen in consultation with a departmental faculty sponsor. Must be taken in partial fulfillment of departmental honors requirements. Prerequisite: A course in physiology; consent of instructor. 2 to 4 hours. May be repeated for a maximum of 10 hours.
295. **Special Topics in General Physiology.** Selected topics in general physiology. Prerequisite: Credit or concurrent registration in Physiology 301; consent of instructor. 2 hours.
296. **Special Topics in Animal Physiology.** Selected topics in animal physiology. Prerequisite: Credit or concurrent registration in Physiology 302; consent of instructor. 2 hours.
301. **General Physiology.** A consideration from the standpoint of experimental biology of functions that are common to most eukaryotic cells. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or $\frac{3}{4}$ unit.

302. **Animal Physiology.** Organ physiology of animals; emphasis on homeostasis and physiological interactions of animals with their environment. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic with laboratory. 3 hours or $\frac{3}{4}$ unit.
303. **General Physiology Laboratory.** An introduction to experimentation with cellular functions common to most eukaryotic cells; emphasis on biochemical, radioactive tracer, electrical, and mechanical recording techniques. Prerequisite: Credit or concurrent registration in Physiology 301. 2 hours or $\frac{1}{4}$ unit.
304. **Experimental Physiology Laboratory.** Introduction to problems and techniques for studying the physiology of organ systems. Prerequisite: Credit or concurrent registration in Physiology 302. 2 hours or $\frac{1}{4}$ unit.
305. **Principles of Ergonomics.** Same as Industrial Engineering and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Industrial Engineering and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
312. **Endocrinology.** Same as Zoology 312. Physiology and biochemistry of the endocrine system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
331. **General Radiobiology.** Response of multicellular organisms, cells, and macromolecules to ionizing radiations. Lectures, student reports, and discussions. Prerequisite: One year each of mathematics, physics, chemistry, and biology. 4 hours or 1 unit.
401. **Physiology of Systems and Organs.** Analysis of organization and function of vertebrate systems, which combines the viewpoints of traditional cellular, comparative, mammalian, and human physiology; nervous, circulatory, digestive, and excretory systems; and gross metabolism. Prerequisite: One year of college-level physics; chemistry through organic; an upper-division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.
402. **Comparative and Adaptational Physiology.** The first half of the course deals with comparative mechanisms of adaptation to the environment, including homeostatic theory, osmotic and ionic regulation, respiration and metabolism, nutrition and digestion, and temperature relations; the second half concerns comparative behavioral physiology, including sense organs, mechanisms of motility (especially muscles), and central nervous integration. Prerequisite: One year of college-level physics; chemistry through organic; an upper-division course in physiology; physical chemistry and biochemistry recommended; knowledge of calculus presumed. 1 unit.
403. **Cellular and Molecular Physiology.** Physicochemical analysis of cellular function and structure; consideration of the implications of the properties of cells for the physiology of multicellular animals. Students may enroll for the lecture series on physiology of cytoplasm and the nucleus, cell growth and division and cellular regulatory mechanisms, and/or for the lecture series on physiology of cell membranes, bioelectrics, and motility. Prerequisite: One year of college-level physics; chemistry including physical and biochemistry; an upper-division course in physiology; knowledge of calculus presumed. $\frac{1}{2}$ or 1 unit.
404. **Physiological Measurements.** Same as Biophysics 404. Laboratories concerned with introducing at a graduate level current research techniques in the physiological and bio-

- physical sciences; problem-oriented laboratories; students select up to four special topics representing different areas of physiology and biophysics, such as mammalian and human, molecular, cellular and radiation biology, comparative physiology, and biophysical measurements. Emphasis placed on ability to work independently, and students give written reports of their experiments. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit. May be repeated to a maximum of 1 $\frac{1}{2}$ units.
410. **Mammalian Physiology Seminar.** Current trends in mammalian physiology. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. $\frac{1}{2}$ unit.
412. **Advanced Endocrinology.** Same as Animal Science, Dairy Science, and Zoology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 2 units.
413. **Experimental Mammalian Physiology.** Same as Veterinary Medical Science 413. Physiological applications of experimental mammalian surgery. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
414. **Experimental Mammalian Physiology.** Physiological applications of experimental pharmacodynamics. Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
416. **Structure and Function of the Nervous System.** Understanding of nervous function through the experimental approach. Prerequisite: Two semesters of physiology courses beyond the elementary level; two semesters of general physics; consent of instructor. 1 unit.
421. **Gross Human Anatomy.** General survey of the structures of the human body with emphasis on the relations between form and function. Prerequisite: One semester of embryology; consent of instructor. 1 unit.
431. **Experimental Radiobiology.** Laboratory exercises in irradiation procedures and in examination of biological responses to ionizing radiations. Prerequisite: Physiology 331 or equivalent; consent of instructor. 1 unit.
441. **Advanced Comparative Physiology.** Seminar, lectures, student reports, and discussions. Topics rotate in three-year cycle: adaptational physiology, comparative neurophysiology, and comparative physiology of motile mechanisms. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
442. **Advanced Comparative Physiology Laboratory.** Laboratory experiments presenting comparative principles in osmotic and ionic regulation; respiration and metabolism; temperature regulation of animals; and physiology of circulatory systems, of muscle, of sense organs, and of nervous systems. Prerequisite: Physiology 402, 403, and 404; credit or concurrent registration in Physiology 441. 1 unit.
451. **Advanced Cellular Physiology.** Seminar, lectures, student reports, and discussions. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
470. **Human Pathologic Physiology.** Disturbances of function in tissues and organs and their relationship to the pathogenesis of human disease. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. $\frac{3}{4}$ unit.
472. **Human Physiology Seminar.** Topics of current emphasis in human physiology. Prerequisite: Two semesters of advanced physiology; one semester of biochemistry; consent of instructor. $\frac{1}{2}$ unit.
473. **Ergonomics Seminar.** Same as Industrial Engineering 473 and Physical Education 473. Topics in ergonomics explored in depth, such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Physiology, Physical Education, or Industrial Engineering 306, or consent of instructor. $\frac{1}{2}$ unit.
490. **Individual Topics.** For graduate students wishing to study individual problems or topics not assigned in other courses. Prerequisite: Approval of department. $\frac{1}{2}$ to 2 units.
499. **Thesis Research.** Research may be conducted in the following areas, with the consent of the instructor: (a) cellular and molecular physiology; (b) comparative physiology; (c) mammalian physiology; (d) human anatomy and human physiology; (e) endocri-

nology; (f) neurophysiology; (g) radiobiology; and (h) environmental and stress physiology. 0 to 4 units.

Zoology

Department Office: 515 Morrill Hall, Urbana

Zoology courses are controlled by the Provisional Departments of Ecology, Ethology, and Evolution and of Genetics and Development.

105. **The Ecosystem Concept.** Introduction to ecological principles; particular emphasis on man in relation to the global environment; evolution of man and the human ecosystem; and consideration of effects of human population growth, energy production, and natural resource utilization as they affect global cyclic mechanisms. 3 hours.
106. **Principles of Heredity.** Introduction to genetics and the laws of inheritance with special emphasis on man; the relationship of genetics to human affairs. No biological training required. Students may not receive credit for Zoology 106 and Biology 210. Prerequisite: Sophomore standing. 3 hours.
107. **Evolution.** Analysis of the theories of evolution, the mechanism of evolutionary changes, and the evolution of man. Prerequisite: Sophomore standing. 3 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology, Home Economics, and Psychology 143. Critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior. Topics to be discussed include communication, social organization, and parental, sexual, and aggressive behavior. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
232. **Comparative Vertebrate Anatomy.** Classification and comparative anatomy of vertebrates including functions and evolution of their organs and organ systems. Prerequisite: Biology 111 or equivalent. 5 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology, and Sociology 246. Introduction to the biosociology of vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
290. **Individual Topics.** Laboratory conferences, and readings. Prerequisite: Two years of zoology; senior standing; approval of department. May be taken by students who can attend classes only on Saturdays. 2 to 5 hours.
304. **Field and Systematic Zoology.** Collection, preservation, and identification of lower vertebrates and land and fresh-water invertebrates: habits and life histories of selected forms. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.
312. **Endocrinology.** Same as Physiology 312. Physiology and biochemistry of the endocrine system with special reference to vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
315. **Human Genetics.** Study of the techniques required for genetic analysis of human traits; discussion of genetic mechanisms operative in human development, metabolism, and behavior; and genetics and human disease. Prerequisite: Biology 210; biochemistry and statistics recommended. 3 hours or $\frac{3}{4}$ unit.
318. **Protozoology.** Basic treatment of the morphology, physiology, and systematics of the protozoa; consideration of their evolution, ecology, morphogenesis, sexual phenomena, genetics, and parasitism with life histories of selected free-living and parasitic forms. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
320. **Invertebrate Zoology.** Invertebrates; structure and development; application of biological principles; specific and comparative morphology of the invertebrates; and coordi-

- nation of structure and function, origin, development, and life histories. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
321. **Parasitology.** Worm parasites: life cycles, morphology, taxonomy, and environmental relations; lecture, laboratory, technic, readings, quiz, demonstrations, and problems. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
330. **Practical Microtechnique.** Introduction to microscopy, microphotography, and histological technique. Prerequisite: Histology or embryology; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
331. **Experimental Cytology.** Same as Botany 331. Lectures on structure and function of the cell; coverage on current concepts of cell and molecular biology relating to cellular function, cell division, and organelle interaction. Prerequisite: Biology 210 or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
332. **The Evolution of Adaptive Systems.** Evolutionary mechanisms underlying adaptations; the relationships among theoretical population biology, developmental biology, functional morphology, and the fossil record, with some emphasis on quantitative models. Prerequisite: Biology 210 and consent of instructor; Biology 310 and a course in calculus recommended. 3 hours or $\frac{3}{4}$ unit.
333. **Vertebrate Embryology.** Development of the vertebrate body and its organs. Prerequisite: Biology 111 or equivalent. 5 hours or 1 unit.
334. **Experimental Cytology Laboratory.** Same as Botany 334. Introduction of cytological techniques, microscopic analysis of macromolecules, isotopic techniques, and autoradiography; phase and fluorescent microscopy and photomicrography. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.
335. **Ornithology.** Structure, functions, environmental relations, habits, life history, and identification of birds. Laboratory during first eight weeks and field trips during last eight weeks of the semester. Prerequisite: Biology 111 or equivalent. 3 hours or $\frac{1}{2}$ unit.
336. **Mammalogy.** Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. Prerequisite: Zoology 232. 4 hours or 1 unit.
337. **Ichthyology.** Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or $\frac{1}{2}$ unit.
339. **Field Vertebrate Natural History.** Laboratory and field course, in two segments, offering two levels of involvement with the material: (1) Section A, survey of North American vertebrates; introduction to their taxonomy, life histories, habitats, and feeding habits. 1 hour or $\frac{1}{4}$ unit. (2) Section B, intensive study of North American vertebrates with emphasis on vertebrates of Illinois; taxonomy, life histories, habitats, and feeding habits of all the common resident species. 4 hours or 1 unit. Prerequisite: Credit or concurrent registration in Zoology 340, or equivalent; consent of instructor for Section B.
340. **Natural History of the Vertebrates.** Lectures on vertebrate adaptations for survival and reproduction. Prerequisite: Biology 111 or equivalent, and junior standing. 3 hours or $\frac{3}{4}$ unit.
341. **Field Ecology.** Study of biotic communities, mammals, birds, reptiles, amphibia, fishes, and invertebrates in various sections of North America during spring vacation; outdoor camping and cooking; and transportation in University cars. Prerequisite: Credit or concurrent registration in one of the following: Zoology 304, 335, 336, 337, 340, or 345; consent of instructor. 1 hour or $\frac{1}{4}$ unit. May be repeated for a maximum of 3 hours.
342. **Wildlife Management and Conservation.** Size and measurement of animal population; factors affecting reproduction and mortality; life history; and management policies for fishes, mammals, and birds. Prerequisite: Biology 111 or equivalent. 3 hours or $\frac{1}{2}$ unit.
343. **Limnology.** Fresh water biology; study of the lake, pond, and river with emphasis on the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. Prerequisite: Biology 111 or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.

344. **Introduction to Primate Morphology and Behavior.** Same as Anthropology 343. Survey of primate social behavior and the classification, morphology, and distribution of living and extinct species; emphasis on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 240 or Zoology 246, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Animal Ecology.** Study of the relationships between organisms and their environment; major emphasis on population dynamics and ecosystem functions and their significance to human populations. Prerequisite: Biology 212 or consent of instructor. 4 or 5 hours, or $\frac{3}{4}$ or 1 unit. Four hours or $\frac{3}{4}$ unit credit requires field work on six Saturdays; 5 hours or 1 unit requires field work on ten Saturdays, including one weekend field trip.
346. **Ethology.** Same as Anthropology 346 and Animal Science 346. Introduction to descriptive and experimental analyses of animal behavior. Prerequisite: One year of courses in zoology, physiology, psychology, or biological anthropology. 3 hours or $\frac{3}{4}$ unit.
347. **Ethology Laboratory.** Same as Anthropology 347 and Animal Science 347. Laboratory in ethology. Prerequisite: Zoology 346 and consent of instructor. 3 hours or $\frac{3}{4}$ unit.
348. **Physiological Bases of Behavior.** Physiological mechanisms underlying behavior as determined through comparative studies; emphasis on the invertebrates; and topics including the functional organization of nervous systems, neurosecretion and synaptic chemistry, sensory physiology, and integration. Prerequisite: Zoology 346 or Psychology 345; Physiology 301 or 302. 3 hours or $\frac{3}{4}$ units.
349. **Ecology and Evolution of Social Structure.** Evaluation of the interplay between social organizations and ecologic factors with emphasis on evolutionary mechanisms and consequences. Prerequisite: Zoology 346; Biology 310. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
350. **Behavior-Genetic Analysis.** Same as Anthropology 342 and Psychology 342. Concepts, methods, and problems in analysis of relations between genetic systems and animal behavior. Prerequisite: Anthropology 240 or Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or $\frac{3}{4}$ or 1 unit.
351. **Viruses, I.** Same as Microbiology and Botany 351. Introduction to the molecular basis of virus growth and development. Prerequisite: Biology 210 or Microbiology 200, or the equivalent background in molecular biology; concurrent registration in Microbiology 330 or Biochemistry 355 recommended. 3 hours or $\frac{3}{4}$ unit.
353. **Hormones and Behavior.** Survey of the behavioral effects of hormones in vertebrates and invertebrates; emphasizes the extensive literature on hormonal effects on reproductive and social behavior. Students enrolled for graduate credit may write a term paper for an extra $1\frac{1}{4}$ -unit credit. Prerequisite: Biology 111. 3 hours, or $\frac{3}{4}$ or 1 unit.
354. **Ethology of Mammals.** Survey of mammalian behavior from an ethological point of view; stresses comparative and evolutionary viewpoints; and includes feeding, communication, biological concepts of motivation and learning, reproduction, parental care, and ontogeny of behavior. Prerequisite: Zoology 336 or 346, Psychology 345, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
356. **Animal Play.** Animal play, including human play, from ecological, ethological, and evolutionary points of view; includes quantitative and structural descriptions of play behavior, age-dependent schedules for play, play as physical training for animals, play as a learning environment and learning mechanism, and play in a sociobiological context. Prerequisite: Zoology 346, Psychology 345, Anthropology 343, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
359. **Aquatic Ecology.** Same as Civil Engineering 347. Integrated study of the environmental factors affecting the composition and distribution of biota in lakes, rivers and estuaries; emphasis on the nature of the response of aquatic ecosystems to stress and practical means of aquatic resource management. Prerequisite: Credit or concurrent registration in Civil Engineering 346 or Zoology 343, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
361. **Individual and Group Behavior of Honey Bees.** Same as Entomology 361 and Horticulture 361. Study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field

- trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit.
367. **Analysis of Development.** Advanced study of basic problems in developmental biology; major emphasis on interactions at molecular, fine structural, and cellular levels; the genetic and metabolic mechanisms by which these interactions are controlled in plants and animals; and critical examination of theories of differentiation in light of recent research. Lectures, discussions, outside readings, and student reports. Prerequisite: Biology 211 or Zoology 333; Biology 210; organic chemistry. 3 hours or $\frac{3}{4}$ unit.
374. **Quantitative Ethology.** Same as Biology 374. Ethological and sociobiological applications of mathematical and statistical concepts and methods to vertebrate and invertebrate behavior: analysis of ethograms; stochastic, informational, and sequential analysis of behavior; use of multidimensional contingency tables in the study of social interactions; mathematical models: evolution of cooperative behavior via individual, kin, and group selection; animal conflict; and animal play. Prerequisite: Zoology 346 or Psychology 345; elementary statistics or probability. 3 hours or $\frac{3}{4}$ unit.
393. **Laboratory in Primate Social Behavior.** Same as Anthropology 393 and Psychology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
402. **Molecular Genetics: Chromosome Mechanics.** Same as Botany and Microbiology 402. Structure and behavior of chromosomes (including replication, repair, and complementation, recombination, and mutation); emphasis on microbial systems and molecular mechanisms. Prerequisite: Microbiology 316 and 330, or consent of instructor. $\frac{3}{4}$ unit.
405. **Molecular Genetics: Gene Action.** Same as Botany and Microbiology 405. Structure, synthesis, and function of molecules and organelles concerned with the intracellular transmission of genetic information, (including gene regulation, transcription, and translation). Prerequisite: Microbiology 330, Microbiology 316 plus biochemistry, or consent of instructor. $\frac{3}{4}$ unit.
406. **Physiology of Reproduction.** Same as Animal Science 406. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. 1 unit.
407. **Evolutionary Theory.** Genetic, systematic, ecological, and zoogeographical concepts as related to the processes of evolution. Prerequisite: One course in genetics; consent of instructor. 1 unit.
408. **Laboratory Methods in Physiology of Reproduction.** Same as Animal Science 408. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
412. **Advanced Endocrinology.** Same as Animal Science, Dairy Science, and Physiology 412. Seminar, lectures, student reports, and discussions of recent advances in endocrinology. Prerequisite: Physiology 312; consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 2 units.
418. **Advanced Protozoology.** Advanced consideration of selected topics, with lectures, discussions and readings; emphasis on laboratory practice in modern methods and techniques of studying both free-living and parasitic protozoa; and collecting, culturing, and staining of representative forms. Prerequisite: Zoology 318 or equivalent. 1 unit.
419. **Topics in Experimental Protozoology.** Consideration of the advantageous employment of protozoa in modern researches concerned with basic biological problems; selected experimental topics covered by lectures, demonstrations, discussions, reports, and readings. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit.
420. **Experimental Invertebrate Zoology.** Study of current research problems and practice in the experimental methods used in the area of invertebrate zoology. Prerequisite: Zoology 320 or equivalent; consent of instructor. 1 unit.

421. **Cytogenetics.** Same as Botany 421. Chromosome theory: the structure, behavior, and physiology of chromosomes in heredity and development. Prerequisite: Biology 210 or Microbiology 330, or consent of instructor. 1 unit.
422. **Advanced Parasitology.** Advanced study of modern methods in helminthology. Prerequisite: Zoology 321 or equivalent. 1 unit.
425. **Experimental Parasitology.** Same as Veterinary Medical Science 425. Broadly based consideration of the relation of parasites to their hosts and to their environments; and of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Biochemistry 350; statistics recommended. 1 unit.
433. **Topics in Developmental Biology.** Study of initial differences in developing systems and interactions leading to more complex differences. May be elected in successive years. Prerequisite: Zoology 367. $\frac{1}{4}$ unit. Maximum credit for master's candidates, 1 unit; for doctoral candidates, 3 units.
443. **Problems in Primate Behavior and Ecology.** Same as Anthropology 443. Group discussions and individual presentations of research reports and problems in fields of primate ethology, ecology, evolution, and related subjects; topics vary each semester. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. May be repeated for additional credit.
444. **Concepts in Ethology.** Group discussion of problems such as stimulus filtering, spontaneity, and stereotyped motor patterns, with a new topic each semester. Prerequisite: Zoology 346. $\frac{1}{2}$ unit.
445. **Seminar in Fish and Wildlife Ecology.** Modern ecological principles and concepts to specific problems in fisheries and wildlife. Prerequisite: Zoology 342 or 345, or equivalent. $\frac{1}{2}$ unit. Offered in alternate years.
490. **Individual Research.** For master's degree candidates who elect to write a research report rather than a thesis. Prerequisite: Consent of adviser. $\frac{1}{2}$ to 3 units. No more than 3 units may be included in the master's degree program.
491. **Topics in Population Biology.** Seminar course devoted to discussion of problems in population biology, with a different topic each semester. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit. May be repeated to a maximum of 4 units.
499. **Thesis Research.** 0 to 4 units.

LINGUISTICS

(See Humanities, School of)

MATHEMATICS

Head of Department: Professor P. T. Bateman

Department Office: 273 Altgeld Hall, Urbana

101. **Basic Mathematics.** Introduction to algebra, designed for the Educational Opportunities Program; topics in arithmetic, measurement, and elementary geometry and algebra. 4 hours.
104. **Elements of Algebra and Trigonometry.** For premedical students and students in the curriculum preparatory to the teaching of biology who have entered with only one unit of high school algebra and who need credit in trigonometry as a prerequisite to physics. Students who enter with one and one-half units of algebra must take Mathematics 114. Credit in Mathematics 104 involves duplication of credit with Mathematics 111, 114,

and 118, and does not serve as a prerequisite for Mathematics 120. Prerequisite: High school algebra, one unit; high school plane geometry, one unit. 3 hours.

111. **Algebra.** Students having one and one-half or more units of high school algebra may not take this course unless they have the approval of their college office. Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, one unit; high school plane geometry, one unit. 5 hours.
112. **College Algebra.** Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, one and one-half units; high school plane geometry, one unit. 3 hours.
114. **Plane Trigonometry.** Prerequisite: Entrance algebra, one and one-half units, or concurrent registration in Mathematics 111; high school plane geometry, one unit. 2 hours.
118. **Introduction to Mathematics, I.** An elementary course for students whose major interests are not in engineering or the physical sciences; provides an overall view of mathematics; emphasizes ideas and concepts rather than routine drill; and includes concepts from the following areas: combinatorics, number theory, the real and rational number systems, topology, representation of numbers, and map coloring. Prerequisite: High school algebra, one unit; high school plane geometry, one unit; or equivalent. 3 hours.
119. **Introduction to Mathematics, II.** Continuation of Mathematics 118; includes concepts from the following areas: combinatorics, algebraic number theory, constructions, cardinal numbers, probability and statistics, analytic geometry, and calculus. Prerequisite: Mathematics 118. 3 hours.
120. **Calculus and Analytic Geometry.** First course in calculus and analytic geometry; basic techniques of differentiation and integration with applications, including curve tracing in the plane. Students with strong backgrounds in analytic geometry should normally enroll in Mathematics 135. Credit is not granted for Mathematics 120 or 135 and Mathematics 134. Prerequisite: Mathematics 111 or 112, and Mathematics 114, or an adequate placement test score. 5 hours.
124. **Introductory Analysis for Social Scientists, I.** An introduction to finite mathematics for students in the social sciences; introduces the student to the basic ideas of logic, set theory, probability vectors and matrices, and Markov chains. Problems are selected from social science and business. Prerequisite: Mathematics 111 or 112, or a passing grade on the Mathematics Placement Test. 3 hours.
130. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections; polar coordinates; parametric equations; vectors and partial derivatives; and first-order differential equations. Prerequisite: Mathematics 120. 5 hours.
131. **Calculus and Analytic Geometry.** Second course in calculus and analytic geometry. Methods of integration; conic sections; polar coordinates; and vectors. Prerequisite: Mathematics 120. 3 hours.
134. **Introductory Analysis for Social Scientists, II.** Introduction to the concepts of functions and relations and the basic ideas of the calculus. Credit is not granted for Mathematics 134 and Mathematics 120 or 135. Prerequisite: Mathematics 124. 4 hours.
135. **Calculus.** First course in calculus. Differentiation and integration; applications to curve-tracing, maxima and minima, area, and volume. Prerequisite: Completion of a thorough college-level course in plane and solid analytic geometry, or equivalent. 5 hours.
140. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Multiple integrals; infinite series; linear algebra; and linear differential equations. Prerequisite: Mathematics 130. 3 hours. Students may not receive credit for both Mathematics 140 and 244.
141. **Calculus and Analytic Geometry.** Third course in calculus and analytic geometry. Parametric equations; partial derivatives; multiple integrals; infinite series; linear algebra; and first-order and linear differential equations. Prerequisite: Mathematics 131. 5 hours. Students may not receive credit for both Mathematics 141 and 244.

145. **Calculus.** Second course in calculus. Further applications of derivatives and integrals; partial derivatives and vectors; multiple integrals; infinite series; and first-order and linear differential equations. Prerequisite: Mathematics 135. 5 hours. Students may not receive credit for Mathematics 145 and 244.
149. **Honors Course in Mathematics.** Prerequisite: Concurrent registration in an honors section of Mathematics 120, 130, 131, 140, or 141; consent of the department. Enrollment is strictly limited to students with superior mathematical talents. 1 hour.
150. **Problem Solving.** The art and techniques of solving mathematical problems; Polya's rules; and heuristics of mathematical problem solving. Prerequisite: Concurrent registration in an honors section of the calculus. 1 hour. May be repeated to a maximum of 4 hours.
161. **Statistics.** Credit is not given for both Mathematics 161 and Economics 171 or Psychology 115. Prerequisite: Mathematics 111 or 112; sophomore standing. 3 hours.
190. **Calculus Computational Laboratory, I.** Introduction to "BASIC" and interactive programming; laboratory treatment of computational aspects of calculus including limits of sequences, derivatives, and approximation methods. Prerequisite: Credit or concurrent registration in Mathematics 120, 134, or 135, or equivalent. 1 hour.
191. **Calculus Computational Laboratory, II.** Continuation of Mathematics 190; topics include continued fractions; the number e ; the maximum problem; symbolic and numerical methods in differentiation and integration; and curve plotting. Prerequisite: Mathematics 190 or consent of instructor; credit or concurrent registration in Mathematics 130, 131, or 145, or equivalent. 1 hour.
192. **Calculus Computational Laboratory, III.** Continuation of Mathematics 191; topics include vectors and arrays in "BASIC"; linear algebra, and numerical and graphical methods of differential equations. Prerequisite: Mathematics 191 or consent of instructor; credit or concurrent registration in Mathematics 140, 141 or 145, or equivalent. 1 hour.
198. **Freshman Seminar.** Guides the student in the study of selected topics not considered in standard courses. Prerequisite: Enrollment in the mathematics honors program; consent of department. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
202. **Mathematics for Elementary Teachers.** A systematic presentation of elementary mathematics for juniors and seniors who are preparing to teach in elementary schools. Topics include decimal numerals, number systems, sets, and introductory algebra. A simultaneous development of teaching methods and materials may be included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Junior standing in elementary education. 5 hours.
203. **Mathematics for Elementary Teachers.** Continuation of Mathematics 202. Topics include measurement, metric and nonmetric geometry, algebra, sets, and introduction to trigonometry, statistics, and probability. A simultaneous development of teaching methods and materials is also included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Mathematics 202 or consent of instructor. 3 hours.
244. **Mathematical Analysis for Social Scientists.** Continuation of Mathematics 134. The calculus of the trigonometric functions, Taylor polynomials, and infinite series; analytic geometry in n dimensions, vector calculus, classical extremum problems in n variables, and Lagrange multipliers; and multiple integrals. Prerequisite: Mathematics 134 or consent of instructor. 5 hours. Students may not receive credit for Mathematics 244 and Mathematics 140, 141, or 145.
250. **Advanced Problem Solving.** Similar to but more advanced than Mathematics 150. Prerequisite: The calculus; and Mathematics 150 or consent of instructor. 1 hour. May be repeated to a maximum of 6 hours.
257. **Introduction to Numerical Analysis.** Same as Computer Science 257. Introduction to the principles and techniques of numerical mathematics for students in the physical sciences; includes topics in roundoff-error analysis, approximation of functions, derivatives and integrals, and numerical solution of nonlinear equations, ordinary differential

equations, and systems of linear equations. The computer is used extensively and a term project may be assigned. Prerequisite: A basic computer science 100-level programming course, one year of calculus, or consent of instructor. 3 hours. Students may not receive credit for both Computer Science/ Mathematics 257 and Computer Science 350.

263. **Statistics in Engineering and the Physical Sciences.** A first course in the use of statistical methods for interpreting the results of experiments; emphasis on applications to engineering and the physical sciences. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours.
290. **Individual Study.** Guided individual study of advanced topics not covered in other courses. Prerequisite: Mathematics 347 with grade of B or better, or consent of department. 2 hours. May be repeated to a maximum of 8 hours.
291. **Honors Individual Study.** Guided individual study of advanced topics not covered in other courses; for students seeking honors credit. Prerequisite: Mathematics 347 with grade of B or better, or consent of Mathematics Honors Committee. 2 hours. May be repeated to a maximum of 8 hours.
296. **Honors Seminar.** Careful study of a selected area of mathematics, carried out either deductively from axioms or inductively through problems; subject matter varies with instructor. Prerequisite: Consent of Mathematics Honors Committee. 3 hours. May be repeated to a maximum of 6 hours.
300. **The Theory of Sets and the Real Number System.** Elementary naive set theory and the development of the integers, the rational numbers, and the real numbers. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
302. **Topics on Geometry.** Historical development of geometry; includes tacit assumptions made by Euclid, Euclid's Fifth Postulate and its equivalents; the discovery of non-Euclidean geometries; geometry as a mathematical structure; finite geometries; geometry as a study of invariants of set transformations; projective geometry; applications of group theory to geometry; and vector geometry. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
303. **Advanced Aspects of Euclidean Geometry.** Selected topics from geometry, for example circum-circle, the nine-point circle, theorems on centroid and ortho-center, the construction of regular figures, isometries in the plane and space, rotations and translations, fixed points, ordered and affine geometries, and geometry of inversive plane. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.
305. **Teacher's Course.** Presents selected topics in mathematics that are related to the content of secondary school mathematics programs; provides background for enrichment topics for secondary school students; and may include, among others, the following topics: number systems, mathematical induction, number theory, probability, graph theory, Boolean algebras and their relation to computer design, ruler and compass constructions, and the geometry of complex numbers. Prerequisite: Mathematics 140, 141, or 145, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **History of Calculus.** An examination of the historical origins and conceptual genesis of the concepts of the calculus. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
307. **Selected Mathematical Topics for Secondary School Teachers.** Deals with the teaching of topics in high school mathematics. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Theory of Interest.** A study of compound interest and annuities; applications to problems in finance. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
311. **Advanced Algebra.** Algebraic methods of summation of infinite series; primarily intended for students interested in actuarial science, but not restricted to such students. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

313. **Combinatorial Mathematics.** Same as Computer Science 313. Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, and block designs. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
314. **Introduction to Set Theory and Mathematical Logic.** Supplies the set-theoretic and logical preliminaries for graduate work in mathematics; includes sets, relations, and mappings; the notions of constant and variable; the integers; cardinal and ordinal numbers; Zorn's lemma; the real numbers; informal account of the propositional calculus and first-order functional calculus; and informal account of various axiomatic theories. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
315. **Linear Transformations and Matrices.** An introductory course emphasizing techniques of linear algebra; topics include matrix operations, determinants, linear equations, vector spaces, linear transformations, eigenvalues, and eigenvectors. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
317. **Introduction to Abstract Algebra.** An introductory course in abstract algebra; includes modular arithmetic, permutations, group theory through the isomorphism theorems, ring theory through the notions of prime and maximal ideals, and additional topics such as unique factorization domains and classification of groups of small order. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
318. **Introduction to Linear Algebra.** Abstract approach emphasizing concept of linear transformation; topics include linear equations, vector spaces, linear transformation, matrices, determinants, invariant subspaces, direct sum decompositions, canonical forms, inner product spaces, and bilinear forms. Prerequisite: Mathematics 317. 3 hours or 1 unit.
319. **Applied Modern Algebra.** Sets and functions, finite-state machines, partially ordered sets, Boolean algebras, normal form of switching functions, the semigroup of a machine, and group codes. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
323. **The Elements of Geometry and Topology, I.** Introduction to geometrical techniques relevant to topology and differential geometry; curves from four viewpoints: topology, differential geometry, combinatorics, and algebraic geometry; and local differential geometry of surfaces. Prerequisite: Mathematics 343. 3 hours or 1 unit.
324. **The Elements of Geometry and Topology, II.** Continuation of Mathematics 323. Three viewpoints of surfaces are studied and interrelated: topology, differential geometry, and combinatorics (algebraic topology). Prerequisite: Mathematics 323. 3 hours or 1 unit.
327. **Introduction to Projective Geometry, I.** Prerequisite: Mathematics 315 or consent of instructor. 3 hours or 1 unit.
332. **Introduction to Set Theory and Topology.** Informal set theory, cardinal and ordinal numbers, and axiom of choice; topology of metric spaces and introduction to general topological spaces. Prerequisite: Credit or concurrent registration in Mathematics 347. 3 hours or 1 unit.
341. **Differential Equations.** A basic course in ordinary differential equations; topics include existence and uniqueness of solutions and the general theory of linear differential equations; treatment is more rigorous than that given in Mathematics 345 but not as rigorous as that given in Mathematics 349. Credit is not given for both Mathematics 341 and 345 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
342. **Differential Equations.** Deals with the theory of Fourier series and applications to solving partial differential equations. Prerequisite: Mathematics 341 or 349. 3 hours or 1 unit.
343. **Advanced Calculus.** Introductory study of vector calculus and functions of several variables; topics include directional derivatives; Jacobians; change of variables in multiple integrals; maxima and minima; line and surface integrals; theorems of Gauss, Green,

- and Stokes; infinite series; and uniform convergence. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
344. **Elementary Real Analysis.** Careful treatment of the theoretical aspects of the calculus of functions of a real variable; topics include the real number system, limits, continuity, derivatives, and the Riemann integral. Credit is not given for both Mathematics 344 and 347. Prerequisite: Mathematics 140, 141, or 145. 3 hours or 1 unit.
345. **Differential Equations and Orthogonal Functions.** Intended for engineering students and others who require a working knowledge of differential equations. Credit is not given for both Mathematics 345 and 341 or 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
346. **Complex Variables and Applications.** For students who desire a working knowledge of complex variables; covers the standard topics; and gives an introduction to integration by residues, the argument principle, conformal maps, Laplace transforms, and potential fields. Students desiring a systematic development of the foundations of the subject should take Mathematics 348. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.
347. **Introduction to Higher Analysis: Real Variables.** Careful development of elementary real analysis including such topics as completeness property of the real number system; basic topological properties of n -dimensional space; convergence of numerical sequences and series of functions; properties of continuous functions; and basic theorems concerning differentiation and Riemann integration. Credit is not given for both Mathematics 344 and 347. Prerequisite: Mathematics 140, 141, or 145 (or equivalent) and junior standing; or consent of instructor. 3 hours or 1 unit.
348. **Introduction to Higher Analysis: Complex Variables.** For students who desire a rigorous introduction to the theory of functions of a complex variable; topics include Cauchy's theorem, the residue theorem, the maximum modulus theorem, Laurent series, the fundamental theorem of algebra, and the argument principle. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 347. 3 hours or 1 unit.
349. **Differential Equations and Orthogonal Functions.** A more rigorous treatment of differential equations than that given in Mathematics 341 and 345. Prerequisite: Mathematics 347. 3 hours or 1 unit. Credit is not given for Mathematics 349 and 341 or 345.
351. **Topics in Applied Mathematics.** A survey course in applied mathematics for secondary school mathematics teachers; deals with topics in the application of matrices to physical and social sciences, and in the applications of Boolean algebra and game theory. Prerequisite: Consent of instructor. 3 hours or 1 unit.
352. **Multivariate Real Analysis.** Rigorous treatment of the calculus of functions of several real variables; topics covered include differentials, maxima and minima, Lagrange multipliers, transformation of multiple integrals, Jacobian's, implicit function theorems, line and surface integrals, Stokes' theorem, and vector analysis. Prerequisite: Mathematics 347. 3 hours or 1 unit.
353. **Elementary Theory of Numbers.** Topics covered include divisibility, primes, congruences, quadratic reciprocity, and Farey sequences. The course objectives are to familiarize students with mathematical proofs and to prepare them for further work in algebra and number theory. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
354. **Theory of Algebraic Numbers.** Topics include Gaussian integers and primes, polynomials, divisibility, algebraic integers, arithmetic in algebraic number fields, ideals, class numbers, and units. Prerequisite: Mathematics 317 or 353. 3 hours or 1 unit.
357. **Mathematical Models in the Social Sciences.** Use of many models drawn from the social sciences to motivate, illustrate, and give a unified development of topics in the following areas: linear algebra, graph theory, Markov chains, and linear and nonlinear systems of difference equations. Prerequisite: Mathematics 134 or equivalent. 3 hours or 1 unit.
358. **Numerical Analysis: Linear Problems.** Same as Computer Science 358. Numerical methods for linear algebra and eigenvalue problems with some applications to linear

boundary value problems for differential equations. Prerequisite: Computer Science/Mathematics 257, Mathematics 315 or 318, and Mathematics 343; or consent of instructor. 3 hours or 1 unit.

359. **Numerical Analysis: Nonlinear Problems.** Same as Computer Science 359. The development and analysis of algorithms for polynomial and spline interpolation; least squares and Chebyshev approximation; interpolatory and Gaussian quadrature; solution of systems of nonlinear equations; and the initial-value problem in ordinary differential equations. Prerequisite: Computer Science/Mathematics 257 and Mathematics 343, or consent of instructor. 3 hours or 1 unit.
361. **Introduction to Probability Theory, I.** Introduction to mathematical probability; includes the calculus of probability, combinatorial analysis, random variables, expectation, distribution functions, moment-generating functions, and central limit theorem. Prepares students for Mathematics 362 and 366. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
362. **Introduction to Mathematical Statistics.** Introduction to mathematical statistics assuming only knowledge of probability theory; includes normal sampling theory, sufficiency, best estimators, maximum likelihood estimators, confidence intervals, most powerful tests, and chi-square tests. Prerequisite: Mathematics 361. 3 hours or 1 unit.
363. **Introduction to Mathematical Statistics and Probability, I.** Introduction to mathematical statistics that develops probability as needed; includes the calculus of probability, random variables, expectation, distribution functions, central limit theorem, point estimation, confidence intervals, and hypothesis testing. Prepares students for Mathematics 364. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
364. **Introduction to Mathematical Statistics and Probability, II.** Continuation of Mathematics 363. Includes moment-generating functions, transformations of random variables, normal sampling theory, sufficiency, best estimators, maximum likelihood estimators, confidence intervals, most powerful tests, unbiased tests, and chi-square tests. Prerequisite: Mathematics 363. 3 hours or 1 unit.
365. **Analysis of Variance.** Estimation and hypotheses testing in linear models; one-, two-, and higher-way layouts; incomplete layouts; analysis of covariance; and random effects models and mixed models. Prerequisite: Credit or concurrent registration in Mathematics 315 and 362 or 364. 3 hours or 1 unit.
366. **Introduction to Probability Theory, II.** Continuation of Mathematics 361. Includes random walks, discrete and continuous time Markov chains, and special topics selected from weak stationarity, multivariate central limit theorem, probability model building, stochastic equations, martingale theory, and renewal theory. Prerequisite: Mathematics 361 or 364. 3 hours or 1 unit.
368. **Topics in Applied Statistics.** Formulation and analysis of mathematical models for random phenomena; student participation in statistical consulting; and instruction in statistical techniques as required. Prerequisite: Mathematics 363 or consent of instructor. 3 hours or 1 unit. May be taken for credit more than once with consent of instructor.
370. **Finite Differences.** Finite differences, finite integration, interpolation, difference equations, numerical integration, and iterative methods of solving equations. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
371. **Actuarial Theory, I.** Single-life mortality functions, annuities, life insurance, premiums, and reserve. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.
372. **Actuarial Theory, II.** Continuation of Mathematics 371. Emphasis is on multiple-life functions. Prerequisite: Mathematics 371. 3 hours or 1 unit.
373. **Combinatorial Computing.** Same as Computer Science 373. Computational aspects of algorithms for solving combinatorial problems; topics include counting and enumeration, sorting, searching, and computational problems in graph theory and algebra. Prerequisite: Mathematics 315 or equivalent, and Computer Science 121 or other

Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.

375. **Automata and Formal Languages, I.** Same as Computer Science 375. Alphabets, languages, and grammars; finite automata, regular expressions, and type 3 grammars; context-free languages and pushdown automata; Turing machines and unsolvability; and Post's correspondence problem and its application to context-free languages. Prerequisite: Mathematics 319 or consent of instructor. 3 hours or 1 unit.
376. **Automata and Formal Languages, II.** Continuation of Mathematics 375. Context sensitive languages and linear bounded automata; operations on languages, closure properties, and abstract families of languages; miscellaneous unsolvable problems; time-and-tape bounded Turing machines; and other topics chosen by the instructor. Prerequisite: Mathematics 375. 3 hours or 1 unit.
377. **Recursive Functions.** Computable functions; Turing computability; recursively enumerable sets; the halting problem; Rice's theorem; recursion theorem; and example of a priority argument. Prerequisite: Mathematics 375 or 314 or 317. 3 hours or 1 unit.
378. **Computer Application to Problems in Mathematics.** Same as Computer Science 378. Discussion of many problems which can be formulated mathematically and lend themselves to computer solution; problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; and game playing and decision problems. Prerequisite: Junior standing; Computer Science 121 or other Computer Science 100-level programming course, or consent of instructor. 3 hours or 1 unit.
381. **Vector and Tensor Analysis.** Prerequisite: Mathematics 343 or equivalent, or consent of instructor. 3 hours or 1 unit.
383. **Linear Programming.** Same as Computer Science 383. Systems of linear inequalities, the standard canonical and general linear problems, and simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.
384. **Nonlinear Programming.** Iterative and analytical solutions of constrained and unconstrained problems of optimization; gradient and conjugate gradient solution methods; Newton's method, LaGrange multipliers, and duality and the Kuhn-Tucker theorem; and quadratic, convex, and geometric programming. Prerequisite: Mathematics 140, 141, or 145, and a knowledge of linear algebra equivalent to Mathematics 315, or equivalent, or consent of instructor. 3 hours or 1 unit.
386. **Laplace Transforms.** Basic operation rules of Laplace transforms through the complex-inversion theorem; applications to solutions of initial and boundary value problems in differential equations; and evaluation of Cauchy integrals. Other types of transforms are considered and used for solving differential equations. Prerequisite: Mathematics 343. 3 hours or 1 unit.
388. **Mathematical Methods in Engineering and Science.** Matrices, determinants, bounds and approximations to eigenvalues, introduction to linear operator theory and inner product spaces, orthogonal expansions, and Fourier transforms. Prerequisite: Mathematics 343 or equivalent. 3 hours or 1 unit.
391. **Switching Theory.** Same as Computer Science 391 and Electrical Engineering 391. Combinational electronic and relay switching networks; two-level design methods; and pulse-mode and fundamental mode sequential networks. Prerequisite: Computer Science 264, Electrical Engineering 290, or Mathematics 319, or consent of instructor. 3 hours or 1 unit.
392. **Finite State Machines.** Same as Electrical Engineering 392 and Computer Science 392. Synchronous machines: state reduction of incompletely specified machines, series parallel decomposition, state assignment, and machine behavior; asynchronous machines: state assignment, hazards, and interacting machines. Prerequisite: Mathematics 319 and Computer Science/Electrical Engineering/Mathematics 391, or consent of instructor. 3 hours or 1 unit.
400. **General Seminar.** General seminar required of all graduate students who have passed the departmental written qualifying examination for the Ph.D. 0 credit.

401. **Second Course in Abstract Algebra, I.** Isomorphism theorems for groups; solvability of p -groups; simplicity of the alternating group on 5 letters; Sylow theorems and Jordan-Hölder theorem; principal ideal domains; Gauss' lemma; Eisenstein's criterion; fundamental theorem of Galois theory; finite fields; cyclotomic fields; and solvability of equations by radicals. Prerequisite: Mathematics 317 and 318. 1 unit.
402. **Second Course in Abstract Algebra, II.** Modules; Hilbert basis theorem; Krull-Schmidt theorem; Wedderburn theorem on semisimple rings; finitely generated modules over principal ideal domains, with applications to abelian groups and canonical forms for matrices; categories and functors; tensor products; and bilinear and quadratic forms. Prerequisite: Mathematics 401. 1 unit.
403. **Theory of Rings.** Ideal theory in commutative rings; structure of noncommutative rings. Prerequisite: Mathematics 402 or equivalent. 1 unit.
404. **Group Theory.** Structure of groups, derived groups, nilpotence and solvability, and extensions and products. Prerequisite: Mathematics 402 or equivalent. 1 unit.
405. **Algebraic Number Theory.** Further development of the theory of fields covering topics from valuation theory, ideal theory, units in algebraic number fields, ramification, function fields, and local class field theory. Prerequisite: Mathematics 402 or equivalent. 1 unit.
406. **Homological Algebra.** Definition and properties of the functors Ext and Tor ; projective, injective, and flat modules; group extensions; dimensions of rings, and Hilbert theorem on syzygies. Prerequisite: Mathematics 402 or equivalent. 1 unit.
407. **Group Representation Theory.** Representation of groups by linear transformations, group algebras, character theory, and modular representations. Prerequisite: Mathematics 401 and 402, or equivalent. 1 unit.
408. **Lie Algebras.** Examples of Lie algebras (low dimensions, Lie algebras of Lie groups, free algebras, and universal enveloping algebra); Poincaré-Birkhoff-Witt theorem; nilpotent and solvable algebras; Cartan subalgebras; structure of semisimple algebras; real forms; and representations. Prerequisite: Mathematics 401; credit or concurrent registration in Mathematics 402. 1 unit.
410. **Logical Foundations of Mathematics.** Development of the predicate calculus of first order as a framework for metamathematical investigations; consideration of the completeness and incompleteness theorems of Gödel. Prerequisite: Mathematics 314 or 317, or consent of instructor. 1 unit.
411. **Model Theory.** Elements of model theory, including Löwenheim-Skolem theorems, categoricity, ultraproducts, and applications to algebra; decidability theory using both model theoretic methods and elimination of quantifiers. Prerequisite: Mathematics 410. 1 unit.
412. **Recursive Function Theory.** Introductions to recursive functions; study of properties of recursive and recursively enumerable sets; degrees of unsolvability; and the implications of the Church-Turing thesis. Prerequisite: Mathematics 410 or consent of instructor. 1 unit.
413. **Set Theory.** Zermelo-Fraenkel axiomatic set theory; consideration of basic concepts in set theory such as ordinal, cardinal, and rank. Prerequisite: Mathematics 410. 1 unit.
414. **Advanced Topics in Logic.** Prerequisite: Mathematics 410; consent of instructor. 1 unit.
415. **Advanced Topics in the Theory of Groups.** Prerequisite: Consent of instructor. 1 unit.
416. **Advanced Topics in Abstract Algebra.** Prerequisite: Consent of instructor. 1 unit.
417. **Category Theory.** Categorical structure of mathematics; categories, functors, and natural transformations; limits, representable functors, and functor categories; adjoint functor theorems and Kan extensions; algebraic theories and tripleable categories; and numerous examples from algebra, topology, and analysis. Prerequisite: Credit or concurrent registration in Mathematics 402 and 435. 1 unit.
418. **Graph Theory.** Structure of graphs; planarity and colorability of graphs; matrices associated with a graph; and automorphism group of a graph. Prerequisite: Mathematics 313, 317, or 319, or equivalent. 1 unit.

419. **Applied Modern Algebra.** A study of polynomial rings and finite fields with applications to the construction and decoding of codes, including BCH codes, correction of burst errors, codes from geometry, codes from Hadamard matrices, and Shannon's fundamental theorem. Prerequisite: Mathematics 317 or 319, or equivalent; or consent of instructor. 3 hours or 1 unit.
422. **Algebraic Geometry.** 1 unit.
423. **Differentiable Manifolds.** Definition and properties of differentiable manifolds and maps, introducing vector fields, tangent bundles, differential forms, exterior derivatives, and foliations. Prerequisite: Mathematics 323 or 381, or consent of instructor. 1 unit.
424. **Riemannian Geometry.** Local and global properties of Riemannian manifolds. Prerequisite: Mathematics 423. 1 unit.
425. **Linear Analysis on Manifolds, I.** Study of topological invariants of differentiable and complex manifolds. Prerequisite: Mathematics 423 and 431, or consent of instructor. 1 unit.
426. **Linear Analysis on Manifolds, II.** Continuation of Mathematics 425. Prerequisite: Mathematics 425. 1 unit.
427. **Lie Groups.** Study of groups which are also differentiable manifolds. Prerequisite: Mathematics 423. 1 unit.
428. **Topics in Geometry.** Prerequisite: Consent of instructor. 1 unit.
430. **Elementary Geometry from a Modern Viewpoint.** Designed for secondary school teachers of mathematics; primary purpose is to discuss critically the logical structure and content of Euclidean geometry from the modern point of view; and consideration is given to the historical development of the modern approach. Prerequisite: One year of experience in the teaching of high school mathematics; consent of instructor. 1 unit.
431. **Algebraic Topology, I.** Homological algebra techniques, simplicial and singular homology, fundamental group and covering spaces, and applications. Prerequisite: Mathematics 318 and 332; concurrent registration in Mathematics 401 or consent of instructor. 1 unit.
432. **Algebraic Topology, II.** Continuation of Mathematics 431. Axiomatic homology theory, fibrations and cofibrations, CW-complexes, cohomology products, and other topics. Prerequisite: Mathematics 431; concurrent registration in Mathematics 402. 1 unit.
433. **Fiber Spaces and Characteristic Classes.** Continuation of Mathematics 432. Study of fiber bundles and their associated characteristic classes, applications to geometric problems. Prerequisite: Mathematics 432. 1 unit.
434. **Polyhedral Topology.** Topology in the piecewise linear category. Prerequisite: Mathematics 431 and 435. 1 unit.
435. **General Topology, I.** Study of topological spaces and maps, including Cartesian products, identifications, connectedness, compactness, uniform spaces, and function space. Prerequisite: Mathematics 332 or consent of instructor. 1 unit.
436. **General Topology, II.** Continuation of Mathematics 435. Prerequisite: Mathematics 435. 1 unit.
438. **Topics in Topology.** Prerequisite: Consent of instructor. 1 unit.
439. **Seminar in Topology.** Prerequisite: Consent of instructor. 1 unit.
440. **Theory of Functions of a Complex Variable, I.** Topics include the Cauchy theory, harmonic functions, entire and meromorphic functions, and the Riemann mapping theorem. Prerequisite: Mathematics 346 and 347, or Mathematics 348. 1 unit.
441. **Real Analysis, I.** Lebesgue measure on the real line; integration and differentiation of real valued functions of a real variable; and additional topics at discretion of instructor. Prerequisite: Mathematics 347 or equivalent. 1 unit.
442. **Real Analysis, II.** Abstract measure theory; integration on general measure spaces; and introduction to functional analysis. Prerequisite: Mathematics 441. 1 unit.
443. **Ordinary Differential Equations.** Existence, uniqueness, and continuation of solutions; topics selected from the following: the theory of linear differential operators, Sturm-Liouville theory, stability theory, and qualitative theory of differential equations. Prerequisite: Mathematics 347; a first course in ordinary differential equations. 1 unit.

444. **Partial Differential Equations.** Prerequisite: Consent of instructor. 1 unit.
445. **Theory of Functions of a Complex Variable, II.** Continuation of Mathematics 440. Topics include subharmonic functions, Nevanlinna theory, analytic continuation and Riemann surfaces, and univalent functions. Prerequisite: Mathematics 440. 1 unit.
446. **Hilbert Space.** Geometrical properties of Hilbert spaces; linear operators; and the spectral theory for self adjoint and related operators. Prerequisite: Mathematics 442. 1 unit.
447. **Banach Spaces.** Geometrical properties of Banach spaces; bounded linear operators; applications to analysis; and linear topological spaces. Prerequisite: Mathematics 442. 1 unit.
448. **Harmonic Analysis.** Locally compact groups; Haar measure; Fourier analysis; and Tauberian theorems. Prerequisite: Mathematics 442. 1 unit.
449. **Banach Algebras.** Properties of Banach algebras and their representation as algebras of continuous functions or algebras of bounded linear operators; applications to spectral theory and harmonic analysis. Prerequisite: Mathematics 446 or 447. 1 unit.
450. **Ordered Spaces.** Study of ordered topological vector spaces and vector lattices and positive operators. Prerequisite: Mathematics 447. 1 unit.
451. **Theory of Probability.** Prerequisite: Mathematics 442. 1 unit.
452. **Theory of Probability.** Prerequisite: Mathematics 451. 1 unit.
453. **Analytic Theory of Numbers, I.** Problems in number theory treated by methods of analysis; topics chosen from prime number theory, Riemann zeta function, sieve methods, diophantine approximation, metric theory, partitions, lattice points, Waring's problem, and asymptotic properties of arithmetical functions. Prerequisite: Mathematics 317 or 348. 1 unit.
454. **Analytic Theory of Numbers, II.** Continuation of Mathematics 453. Prerequisite: Mathematics 453. 1 unit.
455. **Mathematical Methods of Physics.** Introduction to inner product spaces, linear operators, and Schwartz distribution theory; Green's functions for ordinary differential equations; and integral equations: Hilbert-Schmidt theory and Sturm-Liouville theory. Prerequisite: Mathematics 343 and 346. 1 unit.
456. **Mathematical Methods of Physics.** Calculus of variations: Euler-Lagrange theory, Rayleigh-Ritz method, and Dirichlet principle; integral transform methods and separation of variables; and approximation methods: finite differences, Galerkin's method, and asymptotic expansions. Prerequisite: Mathematics 455 or consent of instructor. 1 unit.
457. **Numerical Solution of Ordinary Differential Equations.** Same as Computer Science 457. Derivation and rigorous analysis of one-step, multistep, and extrapolation methods, variable stepsize, error estimation, stiff equations, and boundary value problems. Prerequisite: Computer Science/Mathematics 359 and Mathematics 315 or 318, or consent of instructor. 1 unit.
458. **Topics in Numerical Analysis.** Same as Computer Science 458. Prerequisite: Consent of instructor. 1 unit. May be repeated.
460. **General Relativity and Cosmology.** Same as Astronomy and Physics 424. Foundations of general relativity and applications to problems of astrophysics; includes gravitation as geometry, mathematical tools, Einstein's equations, relativistic stellar structure, black holes and gravitational collapse, cosmology, gravitational radiation, and experimental tests. Prerequisite: Physics 322, 411, 412, and 442, or equivalent; or consent of instructor. 1 unit.
461. **Applied Stochastic Processes.** Introduction to topics such as spectral analysis, filtering theory, and prediction theory of stationary processes; Markov chains and Markov processes. Prerequisite: Mathematics 346 and 347. 1 unit.
463. **Information Theory.** Same as Computer Science 463 and Electrical Engineering 463. Mathematical models for information channels and sources; existence theorems for and construction of error-correcting codes. Prerequisite: Mathematics 361. 1 unit.

465. **Topics in Automata Theory.** Same as Computer Science 465 and Electrical Engineering 465. Prerequisite: Mathematics 392 or consent of instructor. 1 unit.
466. **Topics in Ordinary Differential Equations.** Introduction to current research in such areas as stability and asymptotic behavior of solutions; topological dynamics; numerical methods; and boundary value problems and spectral theory of differential operators. Prerequisite: Consent of instructor. 1 unit.
468. **Topics in Analysis.** Prerequisite: Consent of instructor. 1 unit.
469. **Seminar in Analysis.** Prerequisite: Consent of instructor. 1 unit.
470. **Statistical Decision Functions.** Statistics from the point of view of decision making; introduction to the theory of games; minimax and other decision functions; techniques for determining optimal decision functions; and applications to nonsequential and sequential decision making in practice. Prerequisite: Consent of instructor. 1 unit.
473. **The Theory of Testing Hypotheses.** Methods of constructing statistical tests which have optimum properties in small samples; the principles of invariance, unbiasedness, and similarity; and most stringent tests and minimax tests. Prerequisite: Consent of instructor. 1 unit.
474. **The Theory of Estimation.** Methods of constructing uniformly minimum variance unbiased estimates; minimax estimation; and estimation by confidence sets. Prerequisite: Consent of instructor. 1 unit.
475. **Topics in Combinatorics.** Same as Computer Science 475. Selected topics from graph theory, algebraic coding theory, enumerative analysis, combinatorial design, and discrete optimization; includes other topics of current research interest, such as Ramsey's Theorem, Sperner's Theorem, Dilworth's Theorem, and the theory of matroids. Prerequisite: Computer Science 273, Computer Science/Mathematics 313, or consent of instructor. 1 unit.
478. **Topics in Statistics.** Prerequisite: Consent of instructor. 1 unit.
487. **Theory of Approximation.** Same as Computer Science 487. General approximation theory in normed linear spaces; primary emphasis on functions defined on an interval, and periodic functions; existence and uniqueness theorems; characterization of Chebyshev approximants; degree of approximation; interpolation with emphasis on the quality of interpolants as approximants; and use of approximations in computing. Prerequisite: Mathematics 318 and 348, or consent of instructor. 1 unit.
488. **Topics in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
489. **Seminar in Applied Mathematics.** Prerequisite: Consent of instructor. 1 unit.
490. **Reading Course.** Prerequisite: Consent of instructor. 1 to 2 units.
499. **Thesis Research.** Prerequisite: Consent of instructor. 0 to 4 units.

MECHANICAL AND INDUSTRIAL ENGINEERING

(Including Bioengineering)

Head of Department: Professor B. T. Chao

Department Office: 144 Mechanical Engineering Building, Urbana

Bioengineering

270. **Individual Study.** Individual projects. Prerequisite: Consent of instructor. 0 to 4 hours.
306. **Mechanical Properties of Biological Materials.** Mechanical properties of biological materials important for bioengineering applications; required term papers and oral reports based on literature survey and/or laboratory projects. Prerequisite: Chemistry 131, Physics 108, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

308. **Implant Materials for Medical Applications.** Review of the biological and engineering aspects of implant materials; characterization of major classes of promising implant materials; and problems of tissue-implant interaction and surgical problems involved in implant work. Laboratories and independent projects illustrate the use of implant materials. Prerequisite: Chemistry 102; Physics 102 or 108, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
370. **Special Topics in Bioengineering.** Lecture and discussion relating to new areas of interest. Prerequisites will be announced in the *Timetable* as topics vary. 0 to 4 hours, or 0 to 1 unit. May be repeated as topic varies.
375. **Modeling of Bio-Systems.** Same as Electrical Engineering 375. Application of linear systems theory and feedback control systems analysis to biological systems; sensory receptors, neuro-muscular system models, control of eye movement, the pupil control system, man-machine interactions, parameter identification in biological systems; and optional project laboratory. Prerequisite: General Engineering 222, Mechanical Engineering 265, Aeronautical and Astronautical Engineering 271, or Electrical Engineering 308 or 310; or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
377. **Biomedical Instrumentation.** Same as Electrical Engineering 377. Introduction to engineering aspects of the detection, acquisition, processing, and display of signals from living systems; emphasizes biomedical transducers for measurements of biopotentials, pH, pCO₂, pO₂, force, displacement, pressure, flow, temperature, and impedance; and optional laboratory with animal experiments. Prerequisite: Electrical Engineering 244 and 260, or consent of instructor. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
424. **Ultrasonic Biophysics.** Same as Biophysics 424. Ultrasonic propagation in, and interaction with, biological media at macromolecular, cellular, and organismic levels of structure; meets during the first quarter of the spring semester in alternate years. Prerequisite: Graduate standing in biophysics or consent of instructor. $\frac{1}{4}$ unit.
498. **Individual Study.** Individual projects. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.

Industrial Engineering

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
232. **Methods-Time Analysis.** Principles of motion economy affecting the design of a product or service; the effective use of human effort as related to the tools and equipment used in manufacturing and commercial endeavors; reasons for time study and the principles of determining time standards; study of standard data and other specific types of micromotion standards; and applications of all phases of the studies to specific cases. Prerequisite: Mechanical Engineering 185 or equivalent; junior standing. 3 hours.
238. **Analysis of Data.** Nature of probabilistic models for observed data; discrete and continuous distribution function models; inferences on universe parameters based on sample values; and introduction to control charts, acceptance sampling, and measurement theory. Prerequisite: Completion of basic calculus. 3 hours.
282. **Process Planning and Economy in Manufacturing.** Principles of engineering economy and their applications to manufacturing problems; studies of typical manufacturing processes and their economic factors; and exercises in planning processes for maximum efficiency. Prerequisite: Mechanical Engineering 185 or equivalent; senior standing in engineering. 3 hours.
286. **Operations Analysis.** The development and application of schematic and mathematical models for analysis and decision making relative to the task of coordinating manufacturing activities at optimum levels of economy and efficiency; stress on linear programming. Prerequisite: Industrial Engineering 232 and 238, or consent of instructor. 3 hours.
287. **Job Evaluation and Wage Incentives.** Study of job evaluation techniques and wage incentive systems; problems of installing and maintaining job and position evaluation

systems in industrial organizations. Prerequisite: Industrial Engineering 232 or equivalent; senior standing. 3 hours.

288. **Industrial Systems Analysis and Design.** Application of systems approach to the analysis of interacting industrial procedures; development of decision rules based on analytical treatment of system variables rather than by judgmental methods; and application of computers to the total synthesis and evaluation of operational procedures. Prerequisite: Credit or concurrent registration in Industrial Engineering 282 and 286. 3 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of industrial engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in industrial engineering; must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in industrial engineering research. Prerequisite: Senior standing in industrial engineering; consent of head of department. 3 hours.
296. **Honors Project.** Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Industrial Engineering 293 or 296. 3 hours.
305. **Principles of Ergonomics.** Same as Physiology and Physical Education 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
306. **Quantitative Methods in Ergonomics.** Same as Physiology and Physical Education 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Industrial Engineering 305. 4 hours or 1 unit.
332. **Standard Time Systems.** The study of development, uses, and limitations of standard time data and predetermined time systems. Prerequisite: Industrial Engineering 232. 3 hours, or $\frac{3}{4}$ or 1 unit.
334. **Introduction to Reliability Engineering.** Same as General Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 238 or Mathematics 361, or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Industrial Quality Control.** Control charts for attributes and variables; modified control chart techniques; acceptance sampling for attributes and variables; relationship to design, production, and procurement; quality cost analysis; military standards practice; survey and reports of current quality literature; and management of quality programs. Prerequisite: Industrial Engineering 238 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **Design and Analysis of Industrial Experimentation.** Randomized blocks, t-tests, and factorial and fractional factorial designs; concepts of randomization, blocking, screening, and confounding; second-order designs, response surface methodology, and evolutionary operation; and introduction to mechanistic model building and nonlinear estimation. All topics are treated through engineering applications and case studies.

Prerequisite: Industrial Engineering 238 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

350. **Manufacturing Process and Tool Design.** Study of and exercises in the design of manufacturing processes and tools for maximum efficiency; utilization of computer techniques in the design of manufacturing processes and tools. Prerequisite: Industrial Engineering 282 or undergraduate course in engineering economy. 3 hours, or $\frac{3}{4}$ or 1 unit.
355. **Numerical Control of Manufacturing Processes.** Study of numerical control systems, manufacturing processes, principles and practices basic to numerical control, and programming methodology for numerical control. Prerequisite: Mechanical Engineering 185 or consent of instructor; background in computer technology. 3 hours, or $\frac{3}{4}$ or 1 unit.
357. **Safety Engineering.** Study of engineering principles applied to industrial accident prevention; safe plant layout; safety in maintenance; boilers and pressure vessels; design and application of machine guards; material handling and storage; hand and power tools; welding hazards; electrical hazards; flammable liquids and fire protection; industrial health engineering; and toxic materials. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
358. **Problems in Safety Engineering.** Extended and intensified study of specific safety problems; study of industrial safety procedures and methods of application; provides sound knowledge of accident prevention principles and applications for the student interested in entering the field of safety engineering in industry. Prerequisite: Industrial Engineering 357 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Industrial Engineering Analysis.** Analysis and development of analytical techniques for the solution of problems in industrial engineering; application of statistical methods to uncertainty problems; analysis of linear programming techniques appropriate to the solution of allocation problems dealing with materials, money, men, and machines; and queueing theories applied to maintenance and inventories. Prerequisite: Industrial Engineering 286 and Mathematics 263, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
393. **Special Problems.** Study of advanced problems related to industrial engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or $\frac{1}{2}$ to 1 unit.
401. **Scientific Management, I.** A study of modern management principles on the basis of quantitative methods, concentrating on such operation research techniques as nonlinear and dynamic programming and queueing theory. Prerequisite: Industrial Engineering 386 and Mathematics 361, or consent of instructor. 1 unit.
402. **Scientific Management, II.** A systems approach to industrial problems involving inventory control, scheduling and line balancing, and maintenance and investment theory; application of formally accumulated knowledge of operation research techniques. Problems from industry are assigned to small teams of students. Prerequisite: Business Administration 401 or Industrial Engineering 401; background in computer technology or consent of instructor. 1 to 1 $\frac{1}{2}$ units.
416. **Design of Construction and Industrial Operations, I.** Same as Civil Engineering 416. Conceptual development of a systems design procedure for optimal design of construction and industrial operations; general forms required for critical path networks, linear programs, theory of queues, and inventory models required for systems design; and design evaluation and control models. Prerequisite: Bachelor of Science in civil or industrial engineering; credit or concurrent registration in Mathematics 363; or consent of instructor. 1 unit.
417. **Design of Construction and Industrial Operations, II.** Same as Civil Engineering 417. Continuation of Industrial Engineering 416. Prerequisite: Industrial Engineering 416 or Civil Engineering 416; credit or concurrent registration in Mathematics 315; or consent of instructor. 1 unit.
454. **Production Engineering.** Advanced consideration of production engineering principles as related to cost analysis and reduction, control of flow of work in manufacture, evaluation of performance against standard, and compensation; special investigations. 1 unit.

458. **Laboratory Investigations in Industrial Engineering.** Special investigations of such problems as optimization of operations, programming systems, work standards, plant layout, and flow of materials. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
473. **Ergonomics Seminar.** Same as Physiology 473 and Physical Education 473. In-depth exploration of topics in ergonomics such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Industrial Engineering 306 or consent of instructor. $\frac{1}{2}$ unit.

Mechanical Engineering

185. **Materials Processing and Production Technology.** Technical aspects of manufacturing processes; principles of metal casting, welding, and other processes involving application of heat; mechanics of chip formation; cold forming processes; and conventional and nonconventional metal removal processes. Laboratory experiments and reports. Prerequisite: Chemistry 102; Physics 106; credit or concurrent registration in Mathematics 140, 141, or 145. 4 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
205. **Thermodynamics.** Introduction to classical thermodynamics through the second law; system and control volume analyses of thermodynamic processes; irreversibility and availability; relations among thermodynamics properties; and discussion of microscopic aspects. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
206. **Thermodynamics.** Analysis of processes and systems for power generation and refrigeration; design cases including compressors, pumps, and turbines; mixing, combustion, and heat exchange; and modelling, power cycles, air conditioning, refrigeration, and cryogenics systems. Prerequisite: Mechanical Engineering 205 or 207. 3 hours.
207. **Thermodynamics.** Energy and its transformations; properties of thermodynamic media, including kinetic theory analysis; thermodynamic processes of open and closed systems; reversibility and limitations; entropy and the second law; thermodynamics temperature scales; and second law analysis of chemically reactive systems. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
209. **Thermodynamics and Heat Transfer.** Thermodynamic analysis of energy transfer and transformation; properties of simple working substances; analysis of open and closed systems, direct and reversed cycles, and processes involving transfers of mass and energy; and basic laws of heat transfer. Prerequisite: Mathematics 140, 141, or 145; Physics 107. 3 hours.
210. **Introduction to Engineering Experimentation.** Design and planning of engineering experiments on the basis of scientific analysis; execution of basic engineering experiments using fundamental measurement instruments and techniques; analysis, correlation, and evaluation of experimental data using mathematical and statistical concepts; and introduction and utilization of analog and digital computer methods. Prerequisite: Concurrent registration in Mathematics 345 and Mechanical Engineering 220. 3 hours.
211. **Introductory Gas Dynamics.** Introduction to dynamics; special emphasis on the theory and engineering applications of compressible high velocity flows. Prerequisite: Mathematics 345, Physics 107, and credit or registration in Mechanical Engineering 205. 3 hours.
213. **Heat Transfer.** Principles and application of heat transfer by conduction, convection, and thermal radiation. Prerequisite: Mechanical Engineering 211. 3 hours.
220. **Mechanics of Machinery.** Linkages, cams and gears, velocities, accelerations, inertia forces, vibrations, critical speeds, balancing of engines, and gyroscopes. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or concurrent registration in Theoretical and Applied Mechanics 211; credit or concurrent registration in Computer Science 101. 4 hours.

224. **Machine Analysis and Design.** Application of mathematics, material sciences, and engineering mechanics to problems in analysis and design of machine components; considers function, production, and economic factors of design; and includes fasteners, springs, shafting, and power transmission. Prerequisite: Mechanical Engineering 220 and Theoretical and Applied Mechanics 221. 3 hours.
234. **Heat Treatment of Metals.** Principles of crystal structure in metals; plastic deformation and strengthening mechanisms; application of principles to heat-treating processes and the interrelation among process, microstructure, and physical properties of metals; hardenability and special hardening processes; and selection and heat treatment of metals based on performance requirements. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
250. **Thermal Science Laboratory.** Basic experiments in thermodynamics, gas dynamics, and heat transfer and their applications; experiments selected to introduce pertinent instrumentation and experimental techniques, and to further the understanding of fundamentals via physical observations. Prerequisite: Mechanical Engineering 205 and 213. 3 hours.
254. **Heat Transfer and Gas Dynamics.** Principles and applications of heat transfer; basic concepts of compressible fluid flow. Prerequisite: Mechanical Engineering 205; credit or concurrent registration in Theoretical and Applied Mechanics 235. 3 hours.
257. **Gas Turbines.** Theory, analysis, and performance of gas turbines; thermodynamic cycle analysis; performance parameters; centrifugal and axial compressors; axial flow turbines; and basic laboratory work involving fundamental variables and their effects on performance. Prerequisite: Mechanical Engineering 206 and 211. 3 hours.
260. **Air Flow and Conditioning.** Synthesis of principles of fluid mechanics, heat transfer, and thermodynamics in the flow and conditioning of air; combined heat- and mass-transfer relations for the air-water vapor system; and applications to the engineering design of heating, ventilating, air conditioning, and other process-industry systems. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours.
265. **Principles of Control Systems.** Introduction to servomechanisms and control systems; modeling of dynamic elements, linearization, and block diagram algebra; steady state, transient response and frequency response of control systems; and stability criteria, design, compensation, and performance characteristics. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.
271. **Machine Analysis and System Design.** Application of mathematics, material sciences, and engineering mechanics to problems in analysis and design of machine components; considers function, production, and economic factors of design; and includes gearing, brakes, shafting, critical speeds, lubrication, and design project. Prerequisite: Mechanical Engineering 224. 3 hours.
275. **Creativity in Engineering Design.** Study of engineering systems to show the creative use of scientific principles and design procedures; survey of natural laws and examples of their creative application; and introduction to methods for promoting creativity in engineering. Prerequisite: Mechanical Engineering 271. 3 hours.
284. **Welding Engineering.** Fundamentals of welding and metallurgical effects of temperature cycles involved; physical effects of energy input rates and welding processes on mechanical properties; residual stresses and distortion control; design and economics of welded structures; and laboratory involving welding, physical tests, and metallurgical study of welded joints. Prerequisite: Mechanical Engineering 234 or equivalent; senior standing. 3 hours.
291. **Seminar.** A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of mechanical engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in mechanical engineering; must be taken first semester of senior year. 0 credit.
293. **Special Projects.** Experimental and analytical investigation in mechanical engineering

- research. Prerequisite: Senior standing in mechanical engineering; consent of head of department. 3 hours.
296. **Honors Project.** Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
297. **Honors Seminar.** Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.
299. **Thesis.** Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Mechanical Engineering 293 or 296. 3 hours.
301. **Thermodynamics.** Basic considerations of the three laws of thermodynamics; elementary statistical principles for the prediction of properties of pure substances and mixtures; transport properties; and electric and magnetic systems. Prerequisite: Mechanical Engineering 206 or equivalent; consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
302. **Nuclear Power Engineering.** Same as Nuclear Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering; includes such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
303. **Dynamics of Aerosols and Hydrosols.** Same as Civil Engineering 359. Theory and application of the basic relations of fluid dynamics, thermodynamics, and heat transfer to the motion of aerosols and hydrosols, with application to problems in air and water pollution. Prerequisite: Senior or graduate standing. 3 hours or 1 unit.
305. **Thermodynamics of High-Velocity Flow.** The thermodynamics of gases during high-velocity flow within enclosed channels using Mach number as the fundamental variable; analyses of the basic flow equations, effects of friction, and plane shock theory; and application to thermodynamic cycles involving nozzles, diffusers, compressors, combustion, and turbines. Prerequisite: Mechanical Engineering 205 and 211, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **Industrial Heat Transfer.** Theory and application of numerical, analogical, and experimental methods to selected heat transfer problems; application of principles of convection, condensation, and boiling heat transfer to design of heat exchange equipment. Prerequisite: Undergraduate courses in fluid mechanics and heat transfer, or consent of instructor. 4 hours or 1 unit.
311. **Instrumentation and Measurements.** Same as Agricultural Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; and instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.
312. **Modern Control Theory.** The concept of state; state-space representation of systems; transfer function decomposition and state-variable diagrams; state response of continuous and discrete-data systems; determination of the transition matrix; diagonalization; state response of time-varying systems; controllability and observability; stability and Lyapunov's method; and introduction to optimization and design. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.
314. **Lubrication.** The theoretical basis of lubrication, hydrodynamic bearing theory, and properties of lubricants; lubrication methods and appliances; and study of the lubrication requirements of machines of many kinds. Prerequisite: Undergraduate courses in machine design and fluid mechanics. 3 hours, or $\frac{3}{4}$ or 1 unit.
321. **Refrigeration and Cryogenics.** The theory of operation and the design of equipment for the production of low temperatures from below ambient down to near absolute zero; applications to industrial, consumer, aerospace, medical, and various research

uses. Prerequisite: Mechanical Engineering 205, 211, and 213, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

323. **Design of Thermal Systems.** Selection of components in fluid- and energy-processing systems to meet system performance requirements; computer-aided design; system simulation; optimization techniques; and investment economics and statistical combinations of operating conditions. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours, or $\frac{3}{4}$ or 1 unit.
331. **Internal Combustion Engines.** Study of the fundamental principles underlying the theory and analysis of reciprocating internal combustion engines, fuels, carburetion, combustion, exhaust emissions, detonation, fuel injection, and factors affecting performance; basic laboratory work involving measurements of effects of variables on performance. Prerequisite: Credit or registration in Mechanical Engineering 206, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
332. **Theory of Internal Combustion Engines.** Analysis of internal combustion engines, including thermodynamics, combustion and effects of mixtures, chemical equilibrium and dissociation, exhaust emissions and air pollution, flow through valves, breathing, supercharging and turbocharging, lubrication, friction, and combustion chamber design. Prerequisite: Mechanical Engineering 331 or equivalent, or consent of instructor. 3 hours or 1 unit.
333. **Air Pollution and Combustion.** Same as Aeronautical and Astronautical Engineering 335 and Civil Engineering 358. Natural and man-made pollutants in the atmosphere; fundamentals of stoichiometry, reaction kinetics, and chemical equilibrium as applied to pollutants and their reactions in the air; and all combustion devices which make major contributions to air pollution, and current and possible control techniques for these devices. Prerequisite: Chemistry 102 and Mechanical Engineering 205 or 207, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Power Systems Engineering and Economy.** Application of thermodynamics principles and fluid flow and heat transfer processes to power systems; determination of system characteristics and methods to satisfy these requirements with awareness of economic factors and ecological considerations. Prerequisite: Mechanical Engineering 206, 211, and 213, or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
336. **Automotive Vehicle Dynamics.** Introduction to the dynamics and control of automotive multidegree of freedom systems; the development and solution of governing equations for both steady state and transient conditions by computer simulation techniques; investigation of the performance, handling, and safety aspects of vehicles and their interaction with external and internal interfaces; examination of the influence of tires, suspension, steering, and aerodynamic forces; and laboratory experiments and demonstrations. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 4 hours or 1 unit.
341. **Engineering Analysis and Design.** Correlation of previously acquired design experience with the creative problem of synthesis and analysis that depend upon design judgment. Prerequisite: Mechanical Engineering 271 or senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
342. **Kinematic Analysis and Synthesis.** Geometry of constrained motion; application of mathematical and other techniques to the kinematic analysis and synthesis of mechanisms. Prerequisite: Undergraduate course in kinematics and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
343. **Dynamics of Machinery.** A course complementary to the undergraduate course; emphasis on the analytical approach to the study of dynamic forces in machines, balancing, critical speeds, shaft vibration, governors, and gyroscopes. Prerequisite: Mechanical Engineering 220 and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
344. **Introduction to Optimal Mechanical Design.** Optimal design of mechanical elements and systems; stresses problem formulation, emphasizing derivation and solution of governing equations; and includes choice of appropriate optimization techniques and sen-

sitivity analysis. Topics range from unconstrained single-parameter optimization of mechanical elements to constrained multi-parameter optimization of systems of mechanical elements. Prerequisite: Mechanical Engineering 224 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

- 348. The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, Environmental Studies, General Engineering, Geography, Urban and Regional Planning, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.
- 375. Introduction to Bionics.** Biological concepts and data aiding in the solution of engineering problems; analysis of mechanisms found in living systems and their application to the design of mechanical devices. Prerequisite: Mechanical Engineering 224 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 388. Industrial Control Systems.** The study of industrial control techniques by case studies of actual industrial systems; provides competence in the design, selection, and maintenance of industrial control systems; and introduces applications to electromechanical, pneumatic, thermal, and hydraulic systems. Prerequisite: Mechanical Engineering 265 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 393. Special Problems.** Study of advanced problems related to mechanical engineering. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or $\frac{1}{2}$ to 1 unit.
- 401. Thermodynamics and Transport Properties.** Thermodynamic and microscopic considerations for the prediction of properties; caratheodory principle; relations among properties; microscopic considerations and statistical methods; thermodynamic and transport properties; and fluctuation and nonequilibrium thermodynamics. Prerequisite: Mechanical Engineering 301 or consent of instructor. 1 unit.
- 402. Nonequilibrium Processes.** Dynamics and thermodynamics of multiphase and multi-component systems with special relevance to air pollution control and energy conversion; relaxation phenomena; general motion of systems of disparate elemental masses; diffusion in gravitational and electric fields, and boundary layer motion with mass transport; dispersion and collection of particulate matter; and transport with surface reactions. Prerequisite: Mechanical Engineering 301 and 303, or consent of instructor. 1 unit.
- 403. Fundamentals of Combustion.** Same as Aeronautical and Astronautical Engineering 438. Fundamentals of kinetic theory, transport phenomena, chemical equilibria, and reaction kinetics; flames, their gross properties, structure, and gas dynamics including oscillatory and turbulent burning; solid and liquid propellant combustion; one-dimensional detonation theory including structure and initiation; three-dimensional and other complex detonation waves; and supersonic burning. Prerequisite: Mechanical Engineering 305 or Aeronautical and Astronautical Engineering 213. 1 unit.
- 404. Gas Dynamics, I.** Introduction to theoretical gas dynamics; fundamental laws and basic equations for subsonic, transonic, and supersonic steady and unsteady flow processes. Prerequisite: Mechanical Engineering 305 or equivalent, or consent of instructor. 1 unit.
- 405. Convective Heat Transfer.** Fundamentals of convective heat transfer; calculation of heat transfer within conductor and over submerged objects for laminar and turbulent flow; natural convection; film condensation and boiling; and liquid metals. Prerequisite: Mechanical Engineering 306 or consent of instructor. 1 unit.
- 406. Heat Conduction in Solids.** Fundamentals of heat conduction in isotropic and anisotropic solids; methods of solution to steady and transient heat conduction problems in one, two, and three dimensions; internal heat sources; periodic flow of heat; problems

- involving phase change; and approximate analytical techniques. Prerequisite: Mechanical Engineering 306 or Mathematics 346, or consent of instructor. 1 unit.
408. **Laboratory Investigation in Thermodynamics.** Special investigations involving thermodynamic analysis, thermodynamic properties, and performance of physical and chemical systems. Prerequisite: One-year course in thermodynamics; one half-year course in power laboratory. $\frac{1}{2}$ to $1\frac{1}{2}$ units.
409. **Laboratory Investigations in Fluid Flow, Heat Transfer, and Combustion.** Special investigation in flow, metering, heat transfer, and heat exchanger performance and design. Prerequisite: Courses in thermodynamics and fluid mechanics. $\frac{1}{2}$ to $1\frac{1}{2}$ units.
410. **Thermal Radiation.** Fundamentals of radiant energy transport in absorbing and non-absorbing media; pyrometry; and applications to selected problems involving combined energy transport mechanisms. Prerequisite: Mechanical Engineering 306 or consent of instructor. 1 unit.
411. **Control of Air Pollution from Stationary Sources.** Same as Civil Engineering 448. The study of the basic theory of pollution control devices and their application to air pollution control problems. Prerequisite: Credit or concurrent registration in Civil Engineering 340 and 343, or consent of instructor. 1 unit.
412. **Analysis of Air Pollutants.** Same as Civil Engineering 449. Laboratory analysis of common air pollutants; theory of operation of laboratory and automatic field instrumentation. Prerequisite: Civil Engineering 343 or consent of instructor. $\frac{3}{4}$ unit.
421. **Environmental Control.** Same as Architecture 421. Design of environmental systems for buildings; integration of mechanical, structural, and architectural demand, in lectures and through a semester design project. Prerequisite: Undergraduate degree in architecture or mechanical engineering, or consent of instructor. 1 unit.
423. **Thermal Systems.** Steady-state simulation and optimization of thermal systems, dynamic performance, and probabilities in system design. Prerequisite: Mechanical Engineering 323. 1 unit.
428. **Investigations in Thermal Systems.** Investigations in the modeling, simulation, and optimization of thermal systems such as power generating, heating and cooling, and thermal processing systems. Prerequisite: Consent of instructor. $\frac{1}{2}$ to $1\frac{1}{2}$ units.
429. **Investigations in Environmental Control.** Investigations in heating, ventilating, air conditioning, and human comfort. Prerequisite: Consent of instructor. $\frac{1}{2}$ to $1\frac{1}{2}$ units.
432. **Theory of Rotary Compressors.** Thermodynamical and mechanical fundamentals; compression with and without cooling; classification of compressors; similarity considerations and characteristics; principles of and computations for radial compressors; improvement in performance of integrating parts; axial flow compressors; lattice and airfoil theory; change in operating conditions of turbo-compressors; regulation; and rotary positive blowers. Prerequisite: Mechanical Engineering 205, 206, and 211; or Aeronautical and Astronautical Engineering 211. 1 unit.
438. **Laboratory Investigations in Power Machinery.** Special investigations in power machinery, such as turbines, engines, fans, and compressors. Prerequisite: One-year course in power laboratory. $\frac{1}{2}$ to $1\frac{1}{2}$ units.
441. **Machine Design.** A technical application course that focuses the previously acquired design experience on the creative problem of developing machines to perform specified functions; proper considerations of manufacturing processes involved; and checking of all parts for stress, wear, vibration, fatigue, etc. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.
442. **Linkage Synthesis.** Geometry of constrained motion in two and three dimensions; application of mathematical and other techniques to the synthesis of mechanisms. Prerequisite: Mechanical Engineering 342 or consent of instructor. 1 unit.
443. **Dynamics of Machinery.** Complementary to the undergraduate course and devoted to a more detailed study of velocities, accelerations, and forces in machine parts having reciprocating, rotating, and combined motions; balancing; flywheels; and special topics. Prerequisite: Undergraduate course in dynamics of machines; one year of machine design. 1 unit.

445. **Design of Internal Combustion Engines.** Comprehensive study of the design of internal combustion engines, including gas forces, inertia loads, bearing analysis, torsional vibration, balance, lubrication, valve and cam design, and stress analysis of major parts of the engine. Prerequisite: Mechanical Engineering 271, 331, or equivalent. 1 unit.
448. **Laboratory Investigations in Machine Design.** Special investigations in machine design. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
458. **Laboratory Investigations in Production.** Special investigations in field of production, particularly in materials processing, metal cutting, and production engineering. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
493. **Seminar.** Required of all graduate students each semester with the exception of doctoral candidates who have passed their preliminary examination. Presentation and discussion of significant developments in mechanical engineering. 0 credit.
497. **Special Problems in Mechanical Engineering.** Lectures, seminars, and individual investigations or studies in selected areas of mechanical engineering. Prerequisite: Consent of instructor. 0 to 1 unit. May be repeated.
499. **Thesis Research.** 0 to 4 units.

MEDICAL SCIENCES

Dean of School: Dean D. K. Bloomfield

School Office: 190 Medical Sciences Building, Urbana

300. **Medical Sciences.** First-year program in preparation for the M.D. degree involving guided study of anatomy, behavioral science, biochemistry, genetics, immunology, microbiology, neuroscience, pathology, pharmacology, physiology, and reproductive biology. Elements of clinical experience are included. Learning experiences are monitored and presented by faculty in the clinical and basic medical sciences. Prerequisite: Enrollment is limited to students accepted by the College of Medicine. 19 hours (summer session, 9 hours).
374. **General Epidemiology.** Same as Environmental Studies, Health Education, Veterinary Medical Science, and Veterinary Pathology and Hygiene 374. The epidemiology and natural history of infectious and noninfectious diseases, including integrated vector control and host resistance, and mental health and public health. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent, or consent of instructor. 4 hours or 1 unit.

METALLURGY AND MINING ENGINEERING

Head of Department: Professor C. A. Wert

Department Office: 201 Metallurgy and Mining Building, Urbana

Metallurgical Engineering

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
207. **Extractive Metallurgy.** Basic processes for the recovery of metals from their ores; mineral beneficiation; smelting, refining, and related processes; and hydrometallurgical methods. Prerequisite: Junior standing in metallurgical engineering or equivalent. 3 hours.

296. **Metallurgical Seminar.** Review of current metallurgical literature; classroom reports and discussions; and preparation of technical abstracts and reports. Prerequisite: Senior standing in metallurgical engineering. 2 hours.
299. **Thesis.** Investigation of special problems and preparation of a thesis. May be substituted for certain technical subjects in the senior year. Prerequisite: Senior standing; approval of head of department. 1 to 3 hours.
301. **Welding and Joining Processes.** Same as Civil Engineering 375. The physical principles of fusion welding; heat flow; thermal cycles; physical metallurgy and mechanical properties of welded joints; applications of welding to large structures; testing of welds; nondestructive testing; design, economics, and weld specifications; and laboratory experiments in welding. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
306. **Design of Engineering Alloys.** A study of the fundamental principles which determine the constitution, structure, treatment, and application of alloy steels and other special-purpose high-performance alloys. Prerequisite: Metallurgical Engineering 372. 3 hours, or $\frac{3}{4}$ or 1 unit.
307. **Corrosion of Metals.** Electrochemistry, thermodynamics, and kinetics of corrosion; behavior of ferrous and nonferrous metals; corrosion rates; corrosion control; cathodic and anodic protection; high-temperature corrosion; corrosion testing; and electrolytic machining methods. Prerequisite: Mechanical Engineering 234 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
310. **Crystallography and Diffraction.** Study of structure and composition of solids using X-rays and electron beams; radiography, spectroscopy, and X-ray and electron metallography. Prerequisite: Physics 108. 4 hours or 1 unit.
314. **Metallurgical Thermodynamics.** Thermodynamic principles applied to the study of phase and chemical equilibrium and to the calculation of free energy of phases. 3 hours or $\frac{3}{4}$ unit.
315. **Metallurgical Kinetics.** Diffusion and heat flow calculations and their applications to kinetics of metallurgical processes. Prerequisite: Metallurgical Engineering 314 and 372. 3 hours or $\frac{3}{4}$ unit.
316. **Mechanical Metallurgy.** Fundamentals of plastic deformation of crystalline solids; elementary theory of statics and dynamics of dislocations; applications to deformation of single crystals and polycrystals; fracture; and effect of metallurgical variables on mechanical properties. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
318. **Physics of Metals.** The nature of the perfect and imperfect crystal, the electronic structure of solids, electrical conduction in metals and semiconductors, and dielectric and magnetic properties of solids. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
334. **Physical Metallurgy for Engineers.** Fundamentals of crystallography, imperfections, alloying, and deformation; consideration of composition, temperature, and prior thermal and mechanical treatment in the use of metals, with emphasis on their mechanical properties. Prerequisite: Credit or concurrent registration in Theoretical and Applied Mechanics 221 or Aeronautical and Astronautical Engineering 224, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
370. **Physical Metallurgy, I.** First of a two-semester sequence treating metallurgical phenomena and their utilization in engineering materials and processes; defects, diffusion, phase diagrams, solidification and casting, and plastic deformation and annealing. Prerequisite: Junior standing in engineering; Mathematics 345; Theoretical and Applied Mechanics 221. 3 hours or $\frac{3}{4}$ unit.
371. **Physical Metallurgy Laboratory, I.** Laboratory course to be taken simultaneously with Metallurgical Engineering 370. Experiments using various metallographic, physical, and mechanical property observations to relate structure to properties and illustrate behavior of materials. Prerequisite: Concurrent registration in Metallurgical Engineering 370. 3 hours or 1 unit.

372. **Physical Metallurgy, II.** Continuation of Metallurgical Engineering 370. Precipitation; eutectoid reactions; martensite; ordering; surface reactions; cast iron; and joining. Prerequisite: Metallurgical Engineering 370 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
373. **Physical Metallurgy Laboratory, II.** Laboratory course to be taken simultaneously with Metallurgical Engineering 372. Experiments using various metallographic, physical, and mechanical property observations to relate structure to properties and illustrate behavior of materials. Prerequisite: Concurrent registration in Metallurgical Engineering 372. 3 hours or 1 unit.
384. **Properties of Solids.** Perfect and imperfect crystal lattices; electronic structure of solids including basic theory and applications to transport properties of metals and semiconductors; semiconductor diodes; and dielectric and magnetic properties of solids. Prerequisite: Physics 383. 3 hours or $\frac{3}{4}$ unit.
386. **Electron Microscopy and Diffraction Theory.** Theory and application of transmission electron microscopy and diffraction with emphasis on thin crystals; electron optics, interference phenomena, interpretation of images and diffraction patterns, specimen preparation, etc. Students interested in laboratory experience may enroll in Chemistry 429. Prerequisite: Metallurgical Engineering 310 or equivalent. 3 hours or 1 unit.
387. **Advanced Physical Metallurgy.** Advanced physical metallurgy designed for graduate students whose undergraduate degrees are in engineering or physical science fields other than metallurgy or materials sciences; discusses the standard topics of physical metallurgy with an emphasis on underlying physical principles; and includes selected laboratory experiments. Not to be taken by undergraduates registered in the Department of Metallurgy and Mining Engineering. Students may not receive credit for Metallurgical Engineering 387, and Metallurgical Engineering 370 or 372. Prerequisite: Advanced undergraduate standing in a field other than metallurgy, or graduate standing. 4 hours or 1 unit.
407. **Plastic Deformation and Annealing of Metals.** The mechanism and crystallography of plastic deformation of single crystals and of polycrystalline metals; annealing effects; recovery, subgrain growth, and recrystallization; and deformation textures and annealing textures. Prerequisite: Consent of instructor. 1 unit.
408. **Dislocations and Mechanical Properties of Metals.** General static and dynamic properties of single dislocations in crystals; dislocation interactions; properties of dislocation arrays; and role of dislocations in metallurgical phenomena with particular emphasis on mechanical properties. Prerequisite: Consent of instructor. 1 unit.
409. **Crystal Physics.** The anisotropic properties of crystals treated by tensor and matrix methods with application to paramagnetism, conduction and diffusion, thermoelectricity, deformation, elasticity, and martensitic transformations; discussion of the effects of crystal symmetry and the properties of aggregates. Prerequisite: Vector algebra, determinants, and thermodynamics; consent of instructor. 1 unit.
410. **Advanced X-Ray Metallography.** X-ray diffraction as applied to the study of metals and alloys; effects of cold work, annealing, substructures, preferred orientation, and ordering; and principles of electron and neutron diffraction. Prerequisite: Chemistry 427 or consent of instructor. 1 unit.
420. **Metallurgical Thermodynamics.** Fundamental thermodynamic considerations and applications of thermodynamics to metallurgical problems; particular emphasis on heterogeneous equilibrium and thermodynamic properties of solutions. Topics approached from the viewpoints of both macroscopic thermodynamics and statistical mechanics. Prerequisite: Metallurgical Engineering 314 or equivalent. 1 unit.
421. **Kinetics of Phase Changes in Metals.** The viewpoint of statistical thermodynamics, rate theory, diffusion in solids, interface energy, nucleation theories, and phenomenological analysis of nucleation and growth; application to crystal growth, diffusionless phase changes, oxidation, pearlite reaction, precipitation, and sintering. Prerequisite: Metallurgical Engineering 420 or consent of instructor. 1 unit.
430. **Surface Physics.** Same as Physics 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction

- tion and structure; gas-solid collisions; Brownian motion, diffusion, and evaporation; electron and ion emission, tunnelling; Van der Waals forces; theory of chemical interactions; and kinetics and statistics of adsorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
485. **Metallurgical Engineering Problems.** Individual study in areas of metallurgical engineering not covered by regular course offerings; carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
486. **Laboratory Investigations in Metallurgy.** Special investigations in metallurgy to provide an opportunity to employ some advanced experimental methods of research. Available only to nonthesis students enrolled in a Master of Science program. Prerequisite: Consent of instructor. $\frac{1}{4}$ or $\frac{1}{2}$ unit.
492. **Seminar on Surfaces.** Discussions and lectures on current research on surfaces and related areas. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
493. **Seminar on Anelasticity.** Lectures and discussions of the nature of anelasticity and its application to metallurgy. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
494. **Seminar on Phase Transformations in Metals.** Discussion of current research in this field including presentation by graduate students of their own work. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
495. **Seminar on Diffusion and Imperfections.** Lectures and discussions on diffusion and imperfections in crystalline solids. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
497. **Seminar on Alloy Phases.** Discussion and lectures on current research, including work by the graduate students, relating to the electronic structure and crystal structure of alloy phases. Prerequisite: Consent of instructor. 0 or $\frac{1}{4}$ unit.
498. **Colloquium in Physical Metallurgy.** Review of current metallurgical research in other laboratories by visiting lecturers. Some of the research currently done in the department is also reviewed. Required of all graduate students in metallurgical engineering. No credit.
499. **Thesis Research.** Individual research in specialized problems under the supervision of members of the staff. Results of research may be used for graduate thesis. 0 to 4 units.

Mining Engineering

302. **Political, Economic, and Environmental Aspects of Minerals and Their Utilization.** The availability and utilization of national and world mineral resources and the related environmental, economic, and political implications are examined through lectures, readings, student reports, panel discussions, guest speakers, field trips, and films. Prerequisite: Economics 101 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
351. **Geophysical Prospecting.** Same as Geology 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
356. **Rock Mechanics.** Mechanical properties of rocks; design of mine openings in bedded, massive, and fractured rock; methods of support; drilling; and blasting. Prerequisite: Mining Engineering 351. 3 hours, or $\frac{3}{4}$ or 1 unit.
393. **Special Problems.** Individual studies of any phase of mining or petroleum engineering selected by the student and approved by his adviser and the staff member who supervises the study. Prerequisite: Consent of instructor. 0 to 4 hours, or 0 to 1 unit.
414. **Physical Chemistry of Clays and Soils.** Same as Agronomy 414 and Ceramic Engineering 414. The application of physical chemical principles and concepts to surfaces and adsorption on surfaces; emphasis on silicate surfaces and water adsorption. Prerequisite: Chemistry 340 or equivalent, or consent of instructor. 1 unit. Offered in alternate years.
497. **Special Problems.** Individual studies in areas of mining or petroleum engineering not covered by regular course offerings; carried out under the supervision of a member of the staff. Prerequisite: Consent of instructor. 0 to 2 units.

499. **Thesis Research.** Individual research in some phase of the general field of mining or petroleum engineering under the supervision of a member of the staff. 0 to 4 units.

MICROBIOLOGY

(See Life Sciences)

MILITARY SCIENCE

Head of Department: Lieutenant Colonel D. L. Pinson

Department Office: 110w Armory, Champaign

100. **Leadership Laboratory.** For first semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
101. **Introduction to Military Science (United States Defense Establishment, I).** An introduction to military life, customs, and organization; achievement of a practical working knowledge of individual weapons and their utilization. 1 hour.
102. **Military Map and Aerial Photograph Analysis.** Fundamentals of military map and aerial photograph reading; includes the application of basic principles emphasizing terrain appreciation and evaluation; marginal information; military and topographic map symbols; methods of orientation and resection; military grid reference systems; and classes of aerial photography and methods of obtaining the same. 1 hour.
103. **Introduction to Tactics.** Fundamentals of tactics and their application to the employment of squad- and platoon-sized units in offensive and defensive military operations. Prerequisite: Credit or concurrent registration in Military Science 101; concurrent registration in Military Science 125. 1 hour.
111. **United States Army and National Security (United States Defense Establishment, II).** A survey course in the problems of the United States national defense policy, and the role of the United States Army in implementation of that policy. 1 hour.
112. **American Military History.** Develops certain basic concepts useful for the study of military history and for the study of current problems of national defense; gives the student a sense of perspective and continuity of the main developments in the history of warfare, and the relation of war to society; discussions of land, sea, and air war through an examination of the relation of strategy and tactics to geography, economics, sociology, and technology through the ages; analyzes the relationship between civilians and soldiers in various forms of government; surveys main developments in the history of warfare as they have affected American military history; and examines the effects of nuclear weapons on traditional concepts. 2 hours.
125. **Leadership Laboratory.** For second semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
150. **Leadership Laboratory.** For first semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
175. **Leadership Laboratory.** For second semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics

tics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.

200. **Leadership Laboratory.** For first semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
201. **Principles of Military Instruction.** An introduction to the principles, methods, and techniques fundamental to military instruction to include lesson planning and presentation, use of training aids, and methods of evaluation. 1 hour.
202. **Introductory Military Operations (Fundamentals and Dynamics of the Military Team, I).** The application of the principles of offensive and defensive combat as applied to small tactical units; an analysis of the problem of insurgency and the methods used in its containment; and the means and methods of military communications and their use. Prerequisite: Approval of professor of military science; concurrent registration in Military Science 200 or 225. 3 hours.
203. **Principles of Military Leadership.** Introduces the student to the principles of leadership, the responsibilities and techniques of military leaders, and the problems of leadership in the military environment. 1 hour.
210. **Military Law and Administrative Management.** An introduction to the fundamental concepts of military justice; the basic principles and methods of courts-martial procedure; and principles of nonjudicial punishment. 1 hour.
211. **Proseminar.** A lecture-discussion course utilizing guest lectures in politico-military and military affairs. Individual research projects and readings are required, and a general review of Military Science 102 is included. 2 hours.
212. **Advanced Military Operations (Fundamentals and Dynamics of the Military Team, II).** An advanced study of military operations, logistics, and administration to include the study of the techniques and functions of commanders and staffs, and the fundamentals of supply and administration of platoons and companies. Prerequisite: Approval of professor of military science; concurrent registration in Military Science 250 or 275. 3 hours.
225. **Leadership Laboratory.** For second semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
250. **Leadership Laboratory.** For first semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
275. **Leadership Laboratory.** For second semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics through progressive training in leadership, drill, and command. Field trips may be required. 0 credit.
288. **The Military and Society.** Development of the military as a part of society; includes origins of the interaction between the military and politics, various military sociological models, the military and modernization, and the military and national security. Prerequisite: Junior standing. 3 hours.

MINING ENGINEERING

(See Metallurgy and Mining Engineering)

MUSIC

Director of School: Professor R. E. Bays

School Office: 3050 Music Building, Urbana

100. **Rudiments of Theory.** Notation of key signatures, meter signatures, scales, intervals, chords, and their usage within common practice music; no previous experience in music theory is assumed. Open to students of all colleges of the university. 3 hours. Fine and Applied Arts music majors receive no credit.
101. **Fundamentals of Music Theory and Practice, I.** Notation, vocabulary, and basic concepts, including scales, modes, intervals, chords, and terminology; aural and visual analysis of musical forms and procedures; and stresses the development of melodic, harmonic, and rhythmic vocabularies. Prerequisite: Music 100 or placement into Music 101 by examination. 3 hours.
102. **Fundamentals of Music Theory and Practice, II.** A continuation of Music 101 with gradually increased emphasis on visual elements (score reading and analysis); links theory and practice through analytical understanding. Prerequisite: Music 101. 3 hours.
103. **Selected Studies in Style Analysis, I.** Practical use of the material presented in Music 102. The student may select from a variety of areas of particular emphasis suited to his own interests and curriculum. See *Timetable* for specific offerings. Prerequisite: Music 102. 2 hours. May be repeated for a maximum accumulated credit in Music 103 and/or Music 104 of 8 hours.
104. **Selected Studies in Style Analysis, II.** Practical use of the material presented in Music 102. The student may select from a variety of areas of particular emphasis suited to his own interests and curriculum. See *Timetable* for specific offerings. Prerequisite: Music 102. 2 hours. May be repeated for a maximum accumulated credit in Music 103 and/or Music 104 of 8 hours.
106. **Composition.** Music composition in its beginning and secondary stages; practice in phrase, sentence and period, analysis, and writing; writing of the shorter forms of music; and instruction in range, characteristic, and idiom of instruments. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 hours.
109. **Ear Training and Sight Singing.** An individual course that develops and improves the students' ability to sight sing and to coordinate aural and visual musical disciplines. 1 hour.
110. **Basic Music Literature.** An introduction to the standard concert repertory through intensive guided listening. Representative works by major composers are chosen to illustrate the principal forms, styles, and techniques of vocal and instrumental music emphasizing the period since 1700. Required of freshmen in music. 2 hours.
113. **Appreciation of Music.** Symphonic poems and symphonies. For nonmusic students. Prerequisite: Sophomore standing. 2 hours.
115. **Introduction to Opera.** Introduction to the art form, opera; a survey of its musical and dramatic development from 1600 to the present. Prerequisite: Sophomore standing. 2 hours.
130. **Introduction to the Art of Music, I.** Designed for the layman to train students in intelligent listening and to acquaint them with many great works of the literature of music. For nonmusic students only. Students register for the lecture and one quiz section. 4 hours.

131. **Introduction to the Art of Music, II.** Continuation of Music 130. For nonmusic students only. Prerequisite: Music 130. 4 hours.
133. **Non-Western Music.** A survey of the musics of Asia, Africa, and Oceania and the native traditions of the Americas. 3 hours.
134. **Afro-American Music.** An introduction to Afro-American music in the United States, past and present, including its African and European origins, its relationship to European music, its social and historical context, and its relationship to Afro-American music elsewhere in the New World. Prerequisite: Music 130 or consent of instructor. 3 hours.
140. **Introduction to Music Education.** Basic issues and principles of music education and the teaching profession. 2 hours.
142. **Elements of Conducting.** The development of basic techniques for conducting instrumental and vocal ensembles. Prerequisite: Music student standing or consent of instructor. 2 hours.
150. **Jazz Piano Improvisation, I.** The study of jazz theory, harmony, and improvisational techniques at the piano; includes experience in solo and ensemble situations, and an historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109, or equivalent; consent of instructor. 2 hours.
151. **Jazz Piano Improvisation, II.** Continuation of Music 150. The study of jazz theory, harmony, and improvisational techniques at the piano; includes experience in solo and ensemble situations, and an historical survey of jazz development from about 1910. Prerequisite: Music 162 or equivalent; Music 104 and 109, or equivalent; consent of instructor. 2 hours.
160. **Group Instruction in Piano, I.** Beginning group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument; studies simple piano literature and the development of skills in technique, sight reading, harmonization, transposition, improvisation, and analysis. 2 hours.
161. **Group Instruction in Piano, II.** Elementary group instruction in piano for music majors whose principal performing medium is voice or an orchestral or band instrument; easy solos from the main periods with appropriate technical development; continuation of skills introduced in Music 160; and introduction of piano ensemble literature. Prerequisite: Music 160 or equivalent; consent of instructor. 2 hours.
162. **Group Instruction in Piano, III.** Intermediate group instruction in piano for music majors whose main performing medium is voice or an orchestral or band instrument; study of intermediate level solos and ensemble compositions; harmonization with chromatic chords, sight reading, transposition of four-voice works, improvisation, and learning of patriotic songs. Prerequisite: Music 161 or equivalent; consent of instructor. 2 hours.
163. **Group Instruction in Piano, IV.** Moderately advanced group instruction in piano for music majors whose performing medium is voice or an orchestral or band instrument; continuation of Music 162 with emphasis on solos, ensemble works, technical development, and more advanced work in sight reading, harmonization, improvisation, transposition, and aural skills. 2 hours.
165. **Class Instruction in Voice.** Group instruction in the fundamentals of singing. For School of Music students who do not major in voice; required of such students in music education. 2 hours.
166. **English Diction.** Phonetics applied to English song literature; individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
167. **Italian Diction.** Phonetics applied to Italian song literature; individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour.
168. **German Diction.** German pronunciation as applied to German vocal literature; class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.

169. **French Diction.** Principles of French pronunciation applied to French vocal literature; class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour.
170. **String Instruments.** Class instruction in the fundamentals of playing violin, viola, cello, and string bass. Prerequisite: Junior standing in music or consent of instructor. 2 hours.
171. **Woodwind Instruments.** Class instruction in the fundamentals of playing and teaching clarinet, flute, saxophone, oboe, and bassoon. Prerequisite: Enrollment in the School of Music; for nonmusic majors, consent of instructor. $\frac{1}{2}$ or 2 hours.
172. **Brass Instruments.** Class instruction in the fundamentals of playing and teaching trumpet, French horn, trombone, baritone, and tuba. Prerequisite: Enrollment in the School of Music; for nonmusic majors, consent of instructor. $\frac{1}{2}$ or 2 hours.
173. **Percussion Instruments.** Class instruction in the fundamentals of playing and teaching percussion instruments. Prerequisite: Enrollment in the School of Music; for non majors, consent of instructor. 2 hours.
174. **Guitar Techniques.** Techniques of playing and teaching classic and folk guitar. Prerequisite: Consent of instructor. 2 hours.
175. **Techniques of Teaching Classroom Instruments.** Fundamental techniques for playing the guitar, the recorder, and the autoharp; includes methods for implementing the use of these instruments in the teaching of elementary and junior high school vocal-music classes. 2 hours.
177. **Lute.** Instruction in lute. Prerequisite: Qualifying audition. 2 hours.
178. **Guitar.** Instruction in guitar at the undergraduate level, predominantly classical. 2 or 4 hours (summer session, 1 or 2 hours).
179. **Harpsichord.** Instruction in harpsichord at the undergraduate level. 2 or 4 hours.
180. **Piano.** Instruction in piano at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
181. **Voice.** Instruction in singing at the undergraduate level. 2 or 3 hours (summer session, 1 or 2 hours).
182. **Organ.** Instruction in organ at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
183. **Violin.** Instruction in violin at the undergraduate level. 2 or 4 hours (summer session 1 or 2 hours).
184. **Viola.** Instruction in viola at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
185. **Cello.** Instruction in violoncello at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
186. **String Bass.** Instruction in string bass at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
187. **Flute.** Instruction in flute at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
188. **Clarinet.** Instruction in clarinet at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
189. **Oboe.** Instruction in oboe at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
190. **Bassoon.** Instruction in bassoon at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
191. **Cornet and Trumpet.** Instruction in cornet and trumpet at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
192. **French Horn.** Instruction in French horn at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
193. **Trombone.** Instruction in trombone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
194. **Baritone.** Instruction in baritone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).

195. **Tuba.** Instruction in tuba at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
196. **Percussion.** Instruction in percussion at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
197. **Harp.** Instruction in harp at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
198. **Saxophone.** Instruction in saxophone at the undergraduate level. 2 or 4 hours (summer session, 1 or 2 hours).
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
200. **Instrumentation, I.** Orchestration and arranging for orchestral groups. Prerequisite: Senior standing in music. 2 hours.
201. **Instrumentation, II.** Problems in arranging for all wind instruments. Required of composition majors. Prerequisite: Music 200 or consent of instructor. 2 hours.
202. **Review of Music Theory.** Fundamental terminology and procedures for analysis of western music; representative works from major stylistic periods, with particular attention to the development of the students' understanding of functional elements and analytical techniques. Students may present no more than 14 hours credit in Music 101, 102, 103, 104, and/or 202 for graduation. Prerequisite: One year of music theory at another institution. 3 hours.
209. **Kodaly: Philosophy and Methods.** An introduction to the music education philosophy of Zoltan Kodaly through experiences in relative sol-fa and the expansion of aural awareness. Prerequisite: Consent of instructor. 3 hours.
210. **Computer-Assisted Instruction in Music.** Introduction to computer-assisted instruction (CAI) and its uses in public school, college, and continuing education programs in music; familiarization with visual and audio programming strategies and the research potential of CAI systems. Prerequisite: Consent of instructor. 2 hours.
213. **The History of Music, I.** Survey of music and its development in Western civilization to 1750; emphasis on an acquaintance with representative musical works and style, and on understanding musical concepts in the light of their historical background. Required of all music students. Prerequisite: Music 110 or consent of instructor. 3 hours.
214. **The History of Music, II.** Survey of the development of music as an art in Western civilization from 1750 to the present; emphasis on an acquaintance with formal and stylistic problems through the study of representative works and on understanding specific musical concepts in the light of their historical and general cultural context. Required of all music students. Prerequisite: Music 213. 3 hours.
229. **Thesis and Advanced Undergraduate Honors in Music.** Special individual research projects. Required of seniors in the history of music and composition-theory curricula; open also to advanced undergraduates, including James Scholars, who have achieved University or college honors and who desire to do research in specialized areas of music, including performance. Prerequisite: Senior standing in the history of music and composition-theory, or consent of instructor. 2 hours.
230. **Choral Literature and Conducting, I.** A laboratory course which includes choral literature for secondary choral groups. Students conduct choral singing groups (their conducting is videotaped), learn to analyze and prepare choral scores, and conduct in a choral laboratory. Prerequisite: Music 142. 2 hours.
231. **Choral Literature and Conducting, II.** A laboratory course which includes the study and conducting of public school choral music. Students conduct choral groups, prepare choral scores, learn rehearsal techniques, conduct in a choral laboratory, and conduct vocal ensembles in the public schools. Prerequisite: Music 230. 2 hours.
232. **Instrumental Literature and Conducting, I.** Survey of music literature for wind ensemble and band; principles of interpretation and techniques of conducting emphasized through detailed study and performance of selected compositions. Prerequisite: Music 142. 2 hours.
233. **Instrumental Literature and Conducting, II.** Principles of interpretation and techniques of orchestral conducting emphasized through detailed study and performance of

- selected orchestral compositions appropriate for public school groups. Prerequisite: Music 232. 2 hours.
234. **Workshop in Elementary Music Education.** Detailed consideration of music objectives, principles of learning, and their implications for teaching methods; major emphasis on techniques and materials suitable for teaching music in the elementary school by the classroom teacher. Specifically designed for the experienced classroom teacher. Prerequisite: Consent of instructor; public school teaching experience. 2 hours. Offered in the summer session only.
235. **Elementary and Junior High School Instrumental Music.** Principles, materials, and pedagogical and organizational techniques for teaching instrumental music in the elementary and junior high school. 2 hours.
236. **Choral Techniques in Elementary and Junior High School.** A detailed consideration of literature, arranging for elementary and junior high school choruses, and the changing voice. Prerequisite: Advanced music undergraduate standing or consent of instructor. 3 hours.
237. **Orff: Philosophy and Methods.** An introduction to the Carl Orff-Schulwerk approach to music for children; techniques include the use of Orff instruments and materials and the adaptation of these materials for classroom use with or without instruments. Prerequisite: Sophomore standing in music education or consent of instructor. 2 hours.
238. **Children's Musical Literature.** Critical analysis of music written for children or used in the public schools for the teaching of children. 3 hours.
239. **Teaching Music in the Secondary School.** Comprehensive examination of music teaching at the secondary school level, including what can be taught, how it might be taught, curriculum design and development, scheduling, and administration. Prerequisite: Concurrent registration in Educational Practice 242 or participation in the full semester student teaching program. 3 to 5 hours.
240. **Music for Elementary Teachers, I.** A presentation of music for students preparing to teach in the elementary schools; required for state elementary school certification, but not acceptable for credit in the School of Music. Prerequisite: Junior standing in elementary education or consent of instructor. 3 hours.
241. **Music for Elementary Teachers, II.** Continuation of Music 240. A presentation of music for students preparing to teach in the elementary schools; required for state elementary school certification, but not acceptable for credit in the School of Music. Prerequisite: Music 240. 3 hours.
242. **Teaching Music in the Elementary School.** Techniques of and material suitable for teaching music in the elementary school. 3 hours.
243. **Teaching Music in the Junior High School.** Detailed consideration of the music program in the junior high school; special emphasis on instructional material and methods of instruction. 3 hours.
244. **Teaching of Instrumental Music.** Principles, techniques, organization, and materials for teaching instrumental music in the public school. Prerequisite: Consent of instructor. 2 hours.
245. **Choral Arranging.** Arrangement of suitable materials for choral organizations on the high school level. Prerequisite: Junior standing in music. 2 hours.
246. **Teaching of Choral Music.** A methods course designed for vocal-choral majors; includes techniques of supervision and administration, tone and diction, and rehearsing and singing in styles; and considers materials suitable for organizing and teaching choral music in the public schools. Prerequisite: Music 142, 230, or 231, or consent of instructor. 2 hours.
248. **Music for Early Childhood Teachers, I.** Development of musical competencies essential for teachers in nursery schools and kindergartens; singing, rhythmic keyboard improvisation, and creative and music reading skills and extensive study of music materials suitable for use in early childhood music. 3 hours.
249. **Music for Early Childhood Teachers, II.** Further development of the objectives stated in the description for Music 248; increasing emphasis on individual performance skill

and further survey of materials appropriate for use in early childhood music. Prerequisite: Music 240 or 248, or consent of instructor. 3 hours.

250. **University Orchestra.** Prerequisite: Consent of instructor. 1 hour.
251. **Chamber Orchestra.** A chamber orchestra for the purpose of performing literature of all periods written specifically for a chamber-sized orchestra. Prerequisite: Consent of instructor. 1 hour.
252. **Wind Ensemble.** Mixed woodwind-brass-percussion ensembles for the study and performance of wind chamber compositions. Prerequisite: Junior standing or consent of instructor. 1 hour.
253. **Collegium Musicum.** Ensemble work in the performance of medieval, Renaissance, and baroque music; various small groups formed for the performance of sonatas and canatas of Bach and Handel, wind serenades of Mozart, etc. Interested students may play on viola, lute, harpsicord, and other instruments from the University's collection. Prerequisite: Consent of instructor. 1 hour.
254. **String Ensemble.** The student participates in various ensemble groups, such as trios, quartets, quintets, etc., for the study of chamber music literature. The course may be repeated or taken during the freshman and sophomore year without credit. Prerequisite: Consent of instructor. 1 hour.
255. **Woodwind Ensemble.** Prerequisite: Consent of instructor. 1 hour.
256. **Brass Ensemble.** Ensembles of mixed brasses in both small and large forms. Prerequisite: Consent of instructor. 1 hour.
257. **Percussion Ensemble.** Prerequisite: Consent of instructor. 1 hour.
258. **Piano Ensemble.** Prerequisite: Consent of instructor. 1 hour.
259. **Organ Keyboard Techniques.** Development of practical keyboard skills related to the work of the church organist; transposition, score-reading, harmonization, modulation, hymn-playing, and solo and anthem accompaniment. Prerequisite: Consent of instructor. 1 hour.
260. **Oratorio Society.** Performance of oratorios and other major choral works in cooperation with the University Symphony Orchestra; an advanced mixed-voice chorus open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
261. **University Chorus.** Performance of cantatas and other choral works; a mixed-voice chorus for average and beginning singers. Open to students, faculty, and townspeople. Prerequisite: Consent of instructor. 1 hour.
262. **Women's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all women students. Prerequisite: Consent of instructor. 1 hour.
263. **Men's Glee Club.** Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all men students. Prerequisite: Consent of instructor. 1 hour.
264. **Concert Choir.** Practical experience in mixed-voice singing of accompanied and unaccompanied music of various periods and styles; a highly advanced group of competent student singers. Prerequisite: Consent of instructor. 1 hour.
265. **Opera Workshop and Ensemble.** Preparation and public performance of grand or light opera; covers the music and acting only. Students desiring experience in costuming, stage management, scenery, publicity, etc., should apply to the University Theatre which cooperates in the opera productions. Admission is by audition. Prerequisite: Consent of instructor. 1 hour.
266. **Jazz Band.** Designed to acquaint proficient instrumentalists with jazz compositions, arrangements, and improvisational procedures, and to promote a high degree of stylistic and technical competence in performance. Prerequisite: Consent of instructor, determined by auditions. 1 hour.
267. **Harp Ensemble.** Ensembles of multiple harps and harp in combination with other instruments. Prerequisite: Consent of instructor, or Music 197 and/or 397. 1 hour.
268. **Small Choral Ensembles.** Open to a limited number of undergraduate students who desire experience in performance of music specifically written for smaller choral

- groups. Membership through audition only. Prerequisite: Consent of instructor. 1 hour.
- 300. Eighteenth-Century Counterpoint.** Study of the technique of contrapuntal writing as found in the works of J. S. Bach and other eighteenth-century composers; imitation, canon, invertible counterpoint, two- and three-part inventions, etc., studied through writing and analysis of compositions by eighteenth-century composers. Prerequisite: Music 104 and/or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 301. Fugue.** Study of fugal writing during the eighteenth and early nineteenth centuries; a continuation of the study of tonal counterpoint begun in Music 300, with special emphasis on the study and analysis of the fugal works of J. S. Bach, Handel, and Beethoven, and on the writing of fugues and parts fugues. Prerequisite: Music 300 and/or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 302. Musical Acoustics, I.** History of music, science, and technology; introduction to sets and functions; definition of acoustical parameters: frequency (pitch), amplitude (loudness), and spectrum (sound quality); measurement of decibel level and frequency response; harmonic spectrum analysis; sound perception; acoustic waves; and acoustics of string, wind, and percussion instruments. Prerequisite: Mathematics 111, 112, or 118, or equivalent. 3 hours or $\frac{3}{4}$ unit.
- 303. Musical Acoustics, II.** Acoustics of the voice; speech formants; intervals, scales, tuning, and temperament; auditorium and room acoustics; microphones and loudspeakers, electronic sound reinforcement, and feedback problems; sound recording and reproduction; and sound analysis and synthesis by computer. Prerequisite: Music 302. 3 hours or $\frac{3}{4}$ unit.
- 304. Contemporary Compositional Techniques.** Studies in specialized areas of composition for advanced undergraduates and graduates majoring in composition-theory. May be elected by others with consent of instructor. Prerequisite: Music 104, 106, or 109, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
- 306. Composition.** Work in original composition including the small and large homophonic forms. Prerequisite: Limited to students in composition major curriculum or consent of composition faculty. 2 to 4 hours, or $\frac{1}{2}$ or 1 unit.
- 307. Counterpoint of the Fifteenth and Sixteenth Centuries.** Analysis and writing in the principal contrapuntal styles of the fifteenth and sixteenth centuries; familiarization, through study and singing, with the styles of Dunstable, Dufay, Obrecht, Okeghem, Gombert, Des Pres, Lassus and Palestrina; and writing based on the results of the study of these composers' works. Prerequisite: Junior standing in music or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in 1975-76 and in alternate years.
- 308. Analysis of Musical Form.** Intensive study of representative compositions of the sixteenth through the twentieth centuries for structure and form. Prerequisite: Music 104 and 109, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 309. Electronic Music Techniques.** Introduction to use of electronic music studios; aesthetics of sound composition and compositional techniques; system theory; "classical" sound synthesis and tape manipulation techniques; concept of voltage control and use of voltage-controlled synthesizers; techniques for interaction of live sounds with electronics; and notational problems. Tape composition studies are assigned. Prerequisite: Junior standing in composition-theory or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
- 310. Ancient and Medieval Music.** A history of Western music to about 1400. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 311. Music in the Renaissance.** A history of music from about 1400 to 1600. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 312. Music of the Seventeenth Century.** A history of music from about 1600 to 1700. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 313. Music of the Eighteenth Century.** A history of music from about 1700 to 1800. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
- 314. Music of the Nineteenth Century.** A history of music from about 1800 to 1900. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

315. **Music of the Twentieth Century.** A history of music from about 1900 to the present. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit.
316. **Introduction to Music of the World's Cultures.** Same as Anthropology 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to methods of collecting and studying music in nonliterate, folk, and Asian high cultures. Primarily for students outside the School of Music. Prerequisite: Anthropology 103 or 110, or consent of instructor. 3 hours or ½ unit.
317. **Area Studies in Ethnomusicology.** Same as Anthropology 315. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, or American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or ½ unit. May be repeated to a maximum of 12 hours or 2 units.
318. **History of Performance Practices, I.** Study of musical performance from about 900 to 1650 A.D.; discussion of musical instruments, makeup of instrumental and vocal ensembles, etc., supplemented by demonstration performances of selected works using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history, or consent of instructor. 3 hours or ½ unit.
319. **History of Performance Practices, II.** Study of musical performance from 1600 to 1750 A.D.; discussion of musical instruments, ornamentation, basso continuo, etc., supplemented by demonstration performances using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history, or consent of instructor. 3 hours or ½ unit.
320. **Proseminar.** Special preparation in specialized fields of musicology, theory and composition, and music education. Prerequisite: Senior or graduate standing in music or music education; consent of instructor. 2 or 4 hours, or ½ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
323. **Opera Production, I.** Helps interested students on the graduate level study the problems of the lyric stage; investigation of and practice with casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics. Prerequisite: Music 265 and 381; consent of instructor. 3 hours or ½ unit. May be repeated to a maximum of 6 hours or 1 unit.
324. **Opera Production, II.** Helps interested students on the graduate level study the problems of the lyric stage; investigation of and practice with casting methods, program selections, production procedures, stage direction, coaching methods, and opera dramatics. Prerequisite: Music 323. 3 hours or ½ unit. May be repeated to a maximum of 6 hours or 1 unit.
325. **Introduction to Musicology, I.** Survey of the discipline of musicology, its scope, and its history with bibliographical studies and sample problems for investigation. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or ½ unit).
326. **Introduction to Musicology, II.** Continuation of a survey of the discipline of musicology; special attention to class projects in systematic musicology and to the philosophy of music history. Prerequisite: Music 325 or consent of instructor. 4 hours or 1 unit (summer session, 2 hours or ½ unit).
327. **Urban Popular Music.** Introduction to the world's popular music; emphasis on its role in society, based on American, European, Latin American, and non-Western repertoires. Prerequisite: Music 130 or equivalent, or consent of instructor. 2 hours or ½ unit.
330. **Applied Music Pedagogy.** Survey of techniques, practices, and materials; presentation of group and individual instruction; an approach to teaching problems, tone production, musical styles, and interpretation for various age levels; and actual teaching experience under faculty supervision. Required of applied music majors in piano, voice, and string instruments. Prerequisite: Junior standing in music or consent of instructor. 2 hours or ½ unit. May be repeated to a maximum of 4 hours or 1 unit.
334. **The Music of America, I.** Study of folk, popular, and art music in America from the time of the first European settlers through the middle of the nineteenth century; psalm-

- ody, early opera and concert life, African and European folk music, the singing school, music of European immigrants, and the roots of jazz. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
335. **The Music of America, II.** Study of chamber, choral, and orchestral music written by American composers from 1850 to the present; jazz and its offshoots; folk and popular music; and experimental music in America. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
336. **Music in Latin America.** Studies in the history of music in Latin America from colonial times to the present, including its cultural and social background. Each semester is devoted to a specific area, e.g., Caribbean America and Venezuela, Colombia and the Andean nations, Brazil and the River Plate nations. A reading knowledge of Spanish or Portuguese is recommended. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 6 hours or 1 unit.
340. **Instrumental Clinic and Band Pageantry.** Study of the peculiarities of the individual instruments, criteria for selection, and accepted teaching methods and procedures for each instrument. Band pageantry deals with formation designing, charting and show continuity, marching fundamentals, and special problems. 2 hours or $\frac{1}{2}$ unit.
342. **Percussion Methods.** Designed primarily for teachers of school music who may or may not be percussion performers, but who wish to teach percussion and initiate such a program in the schools. Prerequisite: Senior or graduate standing in music education; Music 174 and 257, or equivalent. 3 hours or $\frac{1}{2}$ unit.
343. **Tests and Measurement in Music Education.** Construction, design, appraisal, and use of measurement devices for music teaching and research. Prerequisite: Consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
345. **Teaching Techniques of Music Theory.** Teaching materials, methods, texts, and pedagogical sequence are discussed and analyzed, including an intensive survey of the structural materials normally covered during the first two years of collegiate study. Prerequisite: Music 300 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
346. **Workshop in Music Education.** Development of essential facts, attitudes, and principles through a consideration of problems encountered in music education. Parallel with this study is the preparation of resource materials for music programs in elementary and secondary schools. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 2 units. Offered in the summer session only.
347. **Teaching of Woodwind Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session of 1974 and in alternate years.
348. **Teaching of Brass Instruments.** Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session of 1974 and in alternate years.
349. **Music in Early Childhood.** Same as Home Economics 349. Detailed consideration of the music program in nursery schools, kindergarten, and the primary grades; topics include the nature of early musical responses, objectives, experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate standing in music or home economics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
350. **Advanced Ensemble Music.** Selected projects in the study and performance of ensemble literature, including the areas of operatic, instrumental, and vocal-choral music and accompanying. Prerequisite: Registration in applied music at the 300-level; consent of instructor. 2 hours or $\frac{1}{2}$ unit (summer session, 1 hour or $\frac{1}{4}$ unit).
355. **Musical Theatre.** Same as Theatre 355. Study of musical theatre and its scores and librettos; consideration of production problems, including those of choreography, scenery, and costume design; and the planning and production of a musical play or score. Prerequisite: Junior standing and consent of instructor. 3 hours or $\frac{1}{2}$ unit.

360. **Advanced Group Instruction in Piano, I.** A comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: sight reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (12 hours completed) or Music 163, and Music 104 and 109, or equivalent; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
361. **Advanced Group Instruction in Piano, II.** Continuation of Music 360. Comprehensive keyboard musicianship course for advanced pianists emphasizing the development of the following skills: sight reading, harmonization, transposition, improvisation, playing by ear, and vocal and instrumental score reading. Ensemble piano music is performed. Prerequisite: Music 180 (12 hours completed) or Music 163; Music 104 and 109 or equivalent; Music 360 or equivalent and consent of instructor. 2 hours or $\frac{1}{2}$ unit.
366. **Vocal Repertoire, I.** To be taken with Music 381. Study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera; supplements the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice or consent of instructor. 1 hour.
367. **Vocal Repertoire, II.** To be taken with Music 381. Study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera; supplements the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice; consent of instructor. 1 hour.
377. **Principles of Accompanying.** Grasp of the fundamental principles of accompanying singers and instrumentalists; practical experience in accompanying; and facility in sight reading for keyboard performers. Prerequisite: Advanced undergraduate or graduate standing in music or music education and consent of instructor. 4 hours or 1 unit (summer session, 2 hours or $\frac{1}{2}$ unit).

Note: Music 378 through 398 (applied music) have the following 16.40 prerequisite: For students in the Bachelor of Music curriculum, junior standing in the major applied music subject; for students in music education, completion of the curricular requirement in the major applied music subject; and for students in other colleges of the University, completion of four semesters in comparable applied music course at the 100-level.

378. **Guitar.** Instruction in guitar at the advanced undergraduate and graduate levels; predominantly classical. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
379. **Harpsichord.** Instruction in harpsichord at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
380. **Piano.** Instruction in piano at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
381. **Voice.** Instruction in singing at the advanced undergraduate and graduate level. 2 or 3 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
382. **Organ.** Instruction in organ at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
383. **Violin.** Instruction in violin at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
384. **Viola.** Instruction in viola at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
385. **Cello.** Instruction in violoncello at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
386. **String Bass.** Instruction in string bass at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
387. **Flute.** Instruction in flute at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
388. **Clarinet.** Instruction in clarinet at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).

389. **Oboe.** Instruction in oboe at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
390. **Bassoon.** Instruction in bassoon at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
391. **Cornet and Trumpet.** Instruction in cornet and trumpet at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
392. **French Horn.** Instruction in French horn at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
393. **Trombone.** Instruction in trombone at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
394. **Baritone.** Instruction in baritone at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
395. **Tuba.** Instruction in tuba at the advanced undergraduate and graduate level. 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
396. **Percussion.** Instruction in percussion at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
397. **Harp.** Instruction in harp at the advanced undergraduate and graduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
398. **Saxophone.** Instruction in saxophone at the advanced undergraduate level. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit).
400. **Advanced Instrumentation: Chamber and Symphonic.** Orchestration for chamber and symphony orchestras; works of classical, romantic, and modern composers. Prerequisite: Undergraduate instrumentation. $\frac{1}{2}$ or 1 unit.
401. **Advanced Instrumentation: Band.** Arrangement for the concert band of works from orchestra, organ, and chamber music by composers of the classical, romantic, and modern periods. Prerequisite: Undergraduate instrumentation. $\frac{1}{2}$ or 1 unit.
402. **Analysis in Relation to Performance and Interpretation, I.** A unifying course in the structure of music, in which analysis is related to the performance and understanding of music; course material drawn from standard literature from the Renaissance to the present day with emphasis on the smaller forms. Prerequisite: Music 104 or equivalent; consent of instructor. 1 unit.
405. **Individual Topics in Music Theory.** Studies in specialized areas of analysis, theory systems, and aesthetics for theory-composition majors. Prerequisite: Graduate standing in music; consent of instructor. $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 3 units.
406. **Composition.** Advanced study of contrapuntal forms; study of contemporary melodic and harmonic practices; and original work in advanced composition. $\frac{1}{2}$ to 1 $\frac{1}{2}$ units.
410. **History of Music Theory.** Prerequisite: Graduate standing in musicology or composition, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
411. **Introduction to Ethnomusicology.** Comprehensive survey of concepts, problems, and methods of research in non-Western and folk music. Prerequisite: Graduate standing in musicology or consent of instructor. 1 unit.
412. **History of Musical Aesthetics, I.** Survey of the principal philosophies of music from Pythagoreanism to the humanistic period, their historical backgrounds, and their relation to musical styles. Prerequisite: Graduate standing in music. $\frac{1}{2}$ or 1 unit.
413. **History of Musical Aesthetics, II.** Survey of the principal philosophies of music, their historical backgrounds, and their relation to musical styles from the seventeenth century to the present day. Prerequisite: Music 412. $\frac{1}{2}$ or 1 unit.
414. **Notation, I.** History of notation from its beginning to 1400. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
415. **Notation, II.** History of notation from 1400 to 1600, including instrumental tablatures. Prerequisite: Music 414 or consent of instructor. $\frac{1}{2}$ unit.
417. **History of Instrumental Music from 1600 to 1750.** Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit.

418. **The Origins and the History of Opera up to Gluck.** The antecedents of opera in the sixteenth century; social, cultural, intellectual forces leading to its development; study of scores, librettos, and scenography; and readings on performance practices, theory, and aesthetics of opera. The principal composers covered are Monteverdi, Cavilli, Cesti, Lully, Rameau, Blow, Purcell, Scarlatti, Handel, and Gluck. $\frac{1}{2}$ or 1 unit. Prerequisite: Music 312 or consent of instructor.
419. **The History of Opera from Mozart to the Present.** A detailed examination of stylistic and structural developments in opera after Gluck, with special reference to representative works from Mozart to Schoenberg viewed in relation to the general musical and cultural background of their time and place of origin. Prerequisite: Music 312 and 313, or consent of instructor. $\frac{1}{2}$ or 1 unit.
420. **Seminar in Music Literature.** Intensive study of outstanding works selected from all fields of music literature. Required of all students (except those in choral music) enrolled in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
421. **Research in Music Education.** Introduction to problems and methods of research in music education. Required of all candidates for the Doctor of Education in music education. Prerequisite: Graduate standing in music or music education. $\frac{1}{2}$ or 1 unit.
422. **Seminar in Theory of Music.** Intensive study of selected topics in the fields of music theory, history of theory, and history of musical materials. Prerequisite: Graduate standing in music theory or consent of instructor. $\frac{1}{2}$ or 1 unit.
423. **Seminar in Musicology.** Problems in historical and systematic musicology or ethnomusicology; discussions of special problems and reports on individual research. Prerequisite: Graduate standing in musicology or consent of instructor. 1 unit.
424. **Seminar in the Works of a Selected Composer.** A seminar devoted to intensive historical and analytical study of the works of important composers; each semester devoted to one composer, e.g., Bach, Beethoven, Handel, Haydn, Mozart, or Wagner. Prerequisite: Music 213 and 214; two of the following: Music 310, 311, 312, 313, or 315, or equivalent. 1 unit (summer session, $\frac{1}{2}$ unit). May be repeated for a maximum of 2 units.
425. **Readings in Musicology and Music Theory.** Individual guidance in intensive readings in the literature of musicology or music theory, selected in consultation with the instructor and in accordance with the needs and interests of the student. Prerequisite: Graduate standing in musicology or music theory. $\frac{1}{2}$ or 1 unit (summer session, $\frac{1}{2}$ unit).
426. **Choral Literature, I.** Survey of choral and vocal ensemble repertoire from the Middle Ages to 1750. Prerequisite: Open to graduate music students by consent of instructor. $\frac{1}{2}$ unit.
427. **Choral Literature, II.** Survey of choral repertoire from 1750 to the present. Prerequisite: Open to graduate music students by consent of instructor. $\frac{1}{2}$ unit.
428. **Problems and Methods.** Introduction to methods in research and stylistic criticism and to bibliographic aids, editions, and editing of music, as related to the work of the musician and composer. Reports of bibliographic problems and on individual projects are presented orally and in writing. Required of all students in the Master of Music program, except those majoring in musicology. 1 unit.
429. **Historical Studies in Twentieth-Century Music.** A seminar in contemporary music, with emphasis on the historical foundations of current trends in musical composition. Prerequisite: Music 315 or 422, or equivalent. $\frac{1}{2}$ to 1 unit (summer session, $\frac{1}{2}$ unit). May be repeated to a maximum of 2 units.
430. **Advanced Orchestra Conducting and Literature.** Intensive study of conducting techniques and problems related to standard orchestral literature; survey of materials for school and community orchestras. Prerequisite: Previous conducting experience. 1 unit.
431. **Advanced Band Conducting and Literature.** Study of problems and techniques of band conducting; survey of literature for the concert band. Prerequisite: Graduate standing in music or music education. 1 unit.

432. **Advanced Choral Techniques, I.** An intensive laboratory approach to the development of advanced techniques necessary for working effectively with choral ensembles. Prerequisite: Graduate standing in music. 1 unit.
433. **Advanced Choral Techniques, II.** An intensive survey of choral literature with laboratory organization for reading, conducting, and interpreting choral music of all periods, styles, and voice arrangements. Prerequisite: Graduate standing in music, Music 432 or equivalent, or consent of instructor. 1 unit.
434. **Piano Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
435. **Vocal Literature.** Study of solo song in larger works, and solo art song. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
436. **Organ Literature.** An intensive study of organ literature from Bach to the present; includes the music itself, recordings, and collateral readings. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
437. **String Instrument Literature.** Prerequisite: Bachelor of Music or Bachelor of Science in Music Education, or consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
438. **Wind Instrument Literature.** Survey at the graduate level of the field of solo and ensemble wind literature; includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. 1 unit. May be repeated for a maximum of 2 units.
439. **Percussion Instruments Literature.** Survey and analysis of the field of solo and ensemble percussion literature; includes analysis and performance, when possible, of the music itself, recordings, and collateral readings. Prerequisite: Graduate standing in music; consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
440. **Foundations and Principles of Music Education, I.** A consideration of the historical and philosophical foundations of music education and their application to the process of program development in music education. Prerequisite: Graduate standing in music education or music. $\frac{1}{2}$ or 1 unit.
441. **Foundations and Principles of Music Education, II.** A consideration of the psychological foundations of music education and their application to the processes of instruction, administration, supervision, and evaluation of music education programs. Prerequisite: Graduate standing in music education or music. $\frac{1}{2}$ or 1 unit.
442. **The General Music Program in Secondary Schools.** Detailed consideration of the general music program, its objectives, organization, and operation; special attention to materials and methods of teaching. $\frac{1}{2}$ or 1 unit.
443. **Administration and Supervision of Music Education.** Deals with the functions of supervisors and directors of music education in administering music programs in elementary and secondary schools. $\frac{1}{2}$ or 1 unit.
444. **The General Music Program in Elementary Schools.** Detailed consideration of elementary general music, its objectives, organization, and operation; special attention to materials and methods of teaching. $\frac{1}{2}$ or 1 unit.
445. **Music in Higher Education.** An orientation to the organization, teaching, and administration of music in the college and university. Prerequisite: Graduate standing in music education or music. $\frac{1}{2}$ or 1 unit.
446. **Seminar in Experimental Music, I.** Survey of contemporary electronic music, computer music, and related types of music; discussion of relevant music theory. Prerequisite: Music 303 or consent of instructor. $\frac{1}{2}$ unit.
447. **Seminar in Experimental Music, II.** Continuation of Music 446. Prerequisite: Music 446 or consent of instructor. $\frac{1}{2}$ unit.
448. **Computer Music.** Representation of sound signals in a digital computer; methods for input and output of sounds to and from a computer; sound synthesis programs; synthesis of simple musical structures; use of graphics; processing of live sounds by computer;

editing and retrieval; fidelity of computer-produced sounds; and hybrid analog/digital computers. Prerequisite: Graduate standing in composition-theory or consent of instructor. $\frac{1}{2}$ unit.

449. **Problems in Band Conducting.** An examination of techniques of rehearsal, conducting, and preparation of band organizations for concert performance; emphasizes discussion, analysis, and preparation of selected scores and the problems they present. Prerequisite: Graduate standing or experience as a band conductor. $\frac{1}{2}$ or 1 unit.
450. **History of Vocal Ensemble and Choral Music, I.** Critical and analytic study of vocal and choral ensemble music from the Middle Ages to 1750. Prerequisite: Music 426 and 427, or consent of instructor. 1 unit (summer session, $\frac{1}{2}$ unit).
451. **History of Vocal Ensemble and Choral Music, II.** Critical and analytic study of vocal and choral ensemble music from 1750 to the present. Prerequisite: Music 450 or consent of instructor. 1 unit (summer session, $\frac{1}{2}$ unit).
452. **Choral Conducting Project.** Required of candidates for the degree of Master of Music with choral music option during the final semester in residence; includes participation in a graduate choral conducting laboratory and preparation of a choral ensemble for public performance. Prerequisite: Music 432 and consent of instructor. $\frac{1}{2}$ unit.
454. **Advanced Choral Performance Techniques.** Study of performance problems and musical analysis of choral music with techniques of preparation and rehearsal from the various style periods: Renaissance, baroque, classic-romantic, and contemporary. Prerequisite: Admission into the Doctor of Musical Arts choral music program, or the equivalent background in other doctoral degree programs. $\frac{1}{2}$ unit. May be repeated to a maximum of 2 units.
455. **The Choral Program in Secondary Schools.** An in-depth study of the methods and materials appropriate for teaching choral music in the secondary schools. Prerequisite: Graduate standing in music or music education. $\frac{1}{2}$ or 1 unit.
477. **Advanced Accompanying.** Grasp of the fundamental principles of accompanying singers and instrumentalists, practical experience in accompanying, and facility in sight reading for keyboard performers. Prerequisite: Graduate standing in music or music education and/or consent of instructor. 1 unit. May be repeated to a maximum of 3 units.
480. **Piano.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
481. **Voice.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
482. **Organ.** Selected studies from the masterworks of organ literature. Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
483. **String Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
484. **Wind Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
485. **Percussion Instruments.** Prerequisite: Bachelor of Music degree; successful completion of a qualifying examination given by the graduate committee. $\frac{1}{2}$ or 1 unit.
489. **Doctoral Projects.** Special projects for candidates for the Doctor of Musical Arts; open only to students in the Doctor of Musical Arts program. Prerequisite: Consent of instructor. 0 to 4 units (summer session, 0 to 2 units).
499. **Thesis Research.** Research in special projects. Prerequisite: Consent of instructor. 0 to 4 units.

NAVAL SCIENCE

Head of Department: Captain J. W. Orrill

Department Office: 239 Armory, Champaign

100. **Naval Science Laboratory.** A noncredit course designed to give the Naval ROTC student, through practical application, a better grasp of the naval science subjects taught in the classroom and a working knowledge of close order drill. 0 credit.
111. **Introduction to Naval Science.** Naval organization and management practices examined within the context of American social and industrial organization and practice; command and control, organization for logistics, service and support, functions and services of major components of the Navy and Marine Corps, and shipboard organization; and emphasis on management and leadership functions. Prerequisite: Approval of professor of naval science; concurrent registration in Naval Science 100. 3 hours.
112. **Naval Ships Systems, I.** Study of ship compartmentation, propulsion systems, auxiliary power systems, interior communications, and ship control; types, structure, and purpose of naval ships; and examination of elements of ship design and ship stability. Prerequisite: Naval Science 111 or consent of instructor. 3 hours.
121. **Naval Ships Systems, II.** Introduction to concepts of naval weapons systems, their capabilities and limitations, and their individual and complimentary roles in a wide variety of offensive and defensive situations. Prerequisite: Credit or concurrent registration in Physics 102 or equivalent, and one course in computer science, or consent of instructor. 3 hours.
122. **American Military Affairs.** An introductory survey of military affairs in the United States from the American Revolution to the present; emphasis on the evolution of the American military establishment, and international and domestic considerations leading to American involvement in international conflicts. Prerequisite: Sophomore standing in NROTC Program or consent of instructor. 3 hours.
231. **Navigation and Naval Operations, I.** Provides the student with an understanding of the theory and techniques of the three types of marine (nautical) navigation: piloting, electronic, and celestial. Prerequisite: Junior standing in NROTC Program; registration in Naval Science 100 or consent of instructor. 3 hours.
232. **Navigation and Naval Operations, II.** Designed to give an understanding of the concepts and use of relative motion principles, international maritime law and the rules of the nautical road, and the fundamentals of U.S. fleet organization, communication, and operations. Prerequisite: Junior standing in NROTC Program; concurrent registration in Naval Science 100, or consent of instructor. 3 hours.
242. **Naval Personnel Administration.** Exploration of the sociological structure of the military, the management practices essential to the effective functioning of that organization, and the role of the junior manager. Much of the instruction will be theoretical, but it will also concentrate in the specific areas of military law and justice, administrative procedures, and applicable personnel management practices, the understanding of which is essential to a well-rounded and qualified officer. Prerequisite: Senior standing in NROTC Program; registration in Naval Science 100 or consent of instructor. 3 hours.
291. **Evolution of Warfare.** Survey of the evolution of warfare; emphasis on the philosophies and trends which have been significant in land warfare. Prerequisite: Advanced undergraduate standing; concurrent registration in Naval Science 100 or consent of instructor. 3 hours.
293. **History of Amphibious Warfare.** Study of amphibious operations and the evolution of amphibious warfare doctrine and development. Prerequisite: Advanced undergraduate standing or consent of instructor. 3 hours.

NUCLEAR ENGINEERING

Chairman of Program: Professor G. H. Miley

Program Office: 214 Nuclear Engineering Laboratory, Urbana

197. **Nuclear Energy and Its Uses.** Discussions and lectures to orient freshmen and sophomores to the role of nuclear engineering in society and technology. 1 hour. May be repeated to a maximum of 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
295. **Special Problems.** Individual investigation of any phase of nuclear engineering selected by the student and approved by the department. Prerequisite: Senior standing and approval of adviser. 1 to 4 hours.
302. **Nuclear Power Engineering.** Same as Mechanical Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering; includes such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.
312. **Nuclear Power Economics and Fuel Management.** A quantitative analysis of the economic impact of the nuclear power industry; nuclear fuel cycle and capital costs for thermal and fast reactors; optimization of the use of nuclear fuels to provide the lowest energy costs and highest system performance; and comparison between fossil fuel systems, fission systems, and controlled thermonuclear systems. Prerequisite: Junior standing; Mechanical Engineering 302, or Nuclear Engineering 302 or 347, or consent of instructor. 3 hours or 1 unit.
321. **Introduction to Controlled Thermonuclear Fusion.** Same as Electrical Engineering 321. Review of Maxwell's equations and introduction to plasma physics as it applies to controlled thermonuclear fusion problems; energy balance; plasma confinement and stability; and recent approaches to the fusion reactor. Prerequisite: Senior or graduate standing, or consent of instructor. 4 hours or 1 unit.
346. **Modern Physics for Nuclear Engineers.** Same as Physics 346. Those fundamentals of quantum theory, atomic structure, and nuclear behavior needed by students before taking advanced courses in nuclear engineering; basic information on radiation types, properties, and interactions. Prerequisite: Junior standing in engineering or physical science. 3 hours or $\frac{3}{4}$ unit.
347. **Introduction to Nuclear Engineering.** Energy resources and nuclear power systems; nuclear particles and nuclear chain reactions; energy release from fission; fast and thermal reactors; reactor theory; radiation shielding; reactor materials and radiation damage; reactor instrumentation, safety, and control; reactor heat removal; and fusion energy sources. Prerequisite: Nuclear Engineering 346 or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
349. **Nuclear Radiation Protection.** Same as Civil Engineering 349. Principles and practice of health physics and radiation protection engineering; includes such topics as principles of dosimetry; sources of ionizing radiation; determination of radiation tolerances; dosimetric instruments; and standards and regulations. Prerequisite: Nuclear Engineering 346 or 397, or equivalent, or consent of instructor. 4 hours or 1 unit.
351. **Nuclear Engineering Laboratory.** Radiation detection and instrumentation; radiation dosimetry and shielding; subcritical assemblies; reactor operations; basic measurements in nuclear engineering; and engineering applications. Prerequisite: Credit or concurrent registration in Nuclear Engineering 347. 3 hours or $\frac{3}{4}$ unit.
355. **Reactor Statics and Dynamics.** Intermediate-level analysis of thermal and fast reactor assemblies; reactor statics, reactor dynamics, and introductory transport theory; homogeneous and heterogeneous reactors; and multigroup diffusion theory, perturbation theory, reactivity coefficients, and control rod analysis. Prerequisite: Nuclear Engineering 347 or equivalent, or consent of instructor. 3 hours or 1 unit.

357. **Nuclear Reactor Safeguards.** Safety problems related to nuclear systems; emphasis on problems concerning nuclear reactors; past nuclear accidents and future prevention; selection of sites; containment of radioactivity; engineered safeguards; safety analysis of operation; legal responsibilities; and public relations. Prerequisite: Nuclear Engineering 302 or 347, or equivalent, or consent of instructor. 3 hours or 1 unit.
358. **Design in Nuclear Engineering.** Introduction to design in nuclear engineering systems; basic principles of definition, organization, constraints, modeling, and optimization of system design; case studies; and class design projects applying these basic principles. Prerequisite: Nuclear Engineering 347. 3 hours or $\frac{3}{4}$ unit.
388. **Nuclear Ceramics.** Same as Ceramic Engineering 388. Study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor; discussion of material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in nonfissile ceramics, and nuclear carbon, graphite, and nonfuel ceramic isotope utilization. Prerequisite: Chemistry 245 or Physics 383, or consent of instructor. 3 hours or 1 unit.
397. **Radiochemistry.** Same as Chemistry 397. Properties of radioactive nuclei; nature of radioactivity; nuclear structure; nuclear reactions; interactions of radiations with matter; chemical aspects of radioactivity work; and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
398. **Radiochemistry Laboratory.** Same as Chemistry 398. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. One laboratory and one discussion period per week. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
401. **Fundamentals of Nuclear Engineering.** A lecture and problem course to provide background for further work in nuclear engineering; problems in materials, heat transfer, and fluid flow; and special emphasis on basic ideas and the mathematical similarity of problems in heat transfer, fluid flow, and neutron diffusion. Prerequisite: Mathematics 345 or equivalent; credit or concurrent registration in Nuclear Engineering 397 or Physics 382, or equivalent. 1 unit.
411. **Nuclear Reactor Heat Transfer.** Selected topics in nuclear reactor heat transfer: thermal analysis of fuel elements under steady and transient operation; convective energy transport from reactor cores; two-phase flow and boiling in reactor cores; and liquid metal coolant systems. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
421. **Nuclear Concepts.** Selected topics in low-energy nuclear physics of general interest to the nuclear engineering field; nuclear reactions; cross sections; slowing down and interactions with matter; decay theory; and nuclear forces. Prerequisite: Credit in a nuclear physics course such as Nuclear Engineering 397 or Physics 382. 1 unit.
422. **Controlled Fusion Systems.** Same as Electrical Engineering 422. Development of plasma models for fusion analysis; treatment of plasma heating and confinement with applications to current experiments; energy balances and energy extraction, minimum-B configuration, instability criteria, Tokamak machines, pinch systems, and mirror systems. Prerequisite: Nuclear Engineering 321 or consent of instructor. 1 unit.
425. **Nuclear-Electrical Energy Conversion.** Same as Electrical Engineering 425. Advanced concepts in nuclear radiation energy conversion of importance in both power production and radiation detection; analysis and applications of direct collection of charged particles; and theory and applications of radiation-induced ionization and excitation. 1 unit.
431. **Nuclear Metallurgy.** Metallurgical principles applied to materials problems in nuclear engineering; includes topics in production of uranium, corrosion, radiation damage, fuel element fabrication, and fuel reprocessing. Prerequisite: Consent of instructor. 1 unit.

441. **Nuclear Radiation Shielding.** Basic concepts, radiation sources, elementary gamma ray and neutron shielding, geometry factors in shielding, advanced techniques (such as Monte Carlo and discrete ordinates), special topics (such as shield heating, duct streaming, and albedo theory), and practical aspects. Prerequisite: Nuclear Engineering 349 or consent of instructor. 1 unit.
451. **Reactor Laboratory.** Reactor operation: start-up, changes in power level, and shut-down; reactor instrumentation: subcritical assemblies; flux measurements in core and thermal column; control rod worth measurements; effects of changes in fuel configurations; and activation and neutron-beam experiments. Prerequisite: Nuclear Engineering 347 or consent of instructor. $\frac{1}{2}$ or 1 unit.
454. **Nuclear Engineering Laboratory Investigations.** Individual laboratory investigations in nuclear engineering. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
455. **Reactor Physics, I.** Same as Physics 455. Introduction to the physical concepts of reactor analysis; nuclear cross sections; diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; and computer applications in reactor analysis. Prerequisite: Nuclear Engineering 355 or equivalent, or consent of instructor. 1 unit.
456. **Reactor Physics, II.** Same as Physics 456. Continuation of Nuclear Engineering 455. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; and digital computer methods. Prerequisite: Nuclear Engineering 455 or consent of instructor. 1 unit.
457. **Methods of Fast Reactor Analysis.** Static and dynamic performance characteristics of fast reactors; multigroup diffusion and transport models for fast power-reactors; construction of multigroup cross-section sets; algorithms for one-dimensional and multidimensional numerical analysis; reactivity coefficients; and fast reactor safety and reliability. Prerequisite: Nuclear Engineering 455. 1 unit.
458. **Nuclear Reactor Engineering.** Development of engineering design phases of the fission chain reactor: reactor materials and radiations; thermal aspects; heat removal; radiation hazards; shielding; reactor performance; controls and instrumentation; types and applications; fuel conversion; and reactor power economics. Prerequisite: Nuclear Engineering 347 or consent of instructor. 1 unit.
460. **Reactor Kinetics.** Discussion of special topics such as response of reactor systems to changes of power demand and reactivity; transfer function analysis, nonlinear problems of reactor dynamics, and reactor stability; fuel cycles; and digital and analog computer methods for solving reactor kinetic problems. Prerequisite: Nuclear Engineering 401; credit or concurrent registration in Nuclear Engineering 455; consent of instructor. 1 unit.
467. **Thermomechanics of Nuclear Reactor Systems.** Same as Theoretical and Applied Mechanics 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal shock and thermal stress-wave propagation; and current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
490. **Special Topics.** Selected areas are considered which are of current interest in research, such as nuclear materials, advanced reactor systems, thermonuclear problems, digital computer methods in nuclear engineering, and advanced topics in reactor theory. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit.
495. **Nuclear Engineering Problems.** Individual study in areas of nuclear engineering and closely related fields not covered by regular course offerings. The work is carried out under the supervision of a member of the staff. Prerequisite: At least 3 units of graduate work; consent of instructor. $\frac{1}{4}$ to 2 units.
497. **Seminar in Nuclear Science and Engineering.** Lectures and discussions on current work in research and development in nuclear engineering and related fields by staff, advanced students, and visiting lecturers. 0 credit.
499. **Thesis Research.** 0 to 4 units.

NURSING

(Including General Nursing, Medical-Surgical Nursing, and Public Health Nursing)

Nursing Administrator: H. M. Rossi

Office: First Floor, 505 East Green Street, Champaign

The following courses are among the first to be offered in the College of Nursing R.N. Baccalaureate Completion Program on the Urbana-Champaign campus. Although these courses are part of the undergraduate program of the College of Nursing at the Medical Center campus, which has ultimate responsibility for them, under a cooperative arrangement they are being offered on the Urbana-Champaign campus as well.

Note: In the following courses, enrollment is limited to students who have senior standing in the College of Nursing R.N. Baccalaureate Completion Program.

General Nursing

- 290. **Seminar in Nursing.** Exploration, reporting, and discussion of issues in nursing and related fields; effect of contemporary concepts and values on nursing today; and speculations about future developments. 2 hours.
- 296. **Research Project in Nursing.** Development of individual project related to the research process. Prerequisite: Nursing 295, Sociology 184, or equivalent. 1 hour.

Medical-Surgical Nursing

- 220. **Medical-Surgical Nursing, II.** Focuses on the nursing process as it relates to the care of individuals with chronic and/or long-term illnesses which require prolonged treatment and physiological and psychosocial adaptations. Prerequisite: Concurrent registration in Nursing 221. 2 hours.
- 221. **Medical-Surgical Nursing II Practicum.** Application of theoretical concepts of rehabilitation to the nursing process in the care of selected patients with long-term and chronic illnesses. Prerequisite: Concurrent registration in Nursing 220. 2 hours.
- 280. **Senior Nursing.** Theoretical concepts of leadership and the management process as related to delivery of health care. Prerequisite: Concurrent registration in Nursing 281. 1 hour.
- 281. **Senior Nursing Practicum.** Application of the theoretical concepts of leadership and the management process as related to delivery of health care. Prerequisite: Concurrent registration in Nursing 280. 1 hour.

Public Health Nursing

- 260. **Public Health Nursing.** Concepts in the provision of comprehensive health care to individuals and families in homes and other community settings. Prerequisite: Nursing 201, Health Education 374, or equivalent; concurrent registration in Nursing 261. 3 hours.
- 261. **Public Health Nursing Practicum.** Focuses on the family and the community as the entities to which public health nursing services are directed. Prerequisite: Nursing 201 or equivalent; concurrent registration in Nursing 260. 3 hours.

NUTRITIONAL SCIENCES

Chairman of Committee: Professor P. V. Johnston

Program Office: 205 Burnside Research Laboratory, Urbana

400. **Nutritional Sciences Seminar.** Discussions of current problems in nutritional sciences. Required of all graduate students in the nutritional sciences program. Prerequisite: Nutritional Sciences 410. $\frac{1}{4}$ unit.
410. **Current Topics in Nutritional Research.** Same as Dairy Science and Food Science 410. Discussion of current research problems in experimental nutrition. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. $\frac{3}{4}$ unit.
411. **Chemistry of Nutritional Processes.** Same as Dairy Science and Food Science 411. Biochemical aspects of nutrition with emphasis on the function, regulation, and metabolism of nutrients in man. Prerequisite: Biochemistry 350 or 352; an upper-level course in nutrition. 1 unit.
493. **Individual Topics in Nutrition.** For students majoring in nutritional sciences who wish to undertake individual studies of a nonthesis nature in problems or topics not covered in other courses; may be taken under the direction of any member of the nutritional sciences faculty, with the exception of the student's own thesis adviser. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 2 units.
499. **Thesis Research.** 0 to 4 units (summer session, 0 to 2 units).

OCCUPATIONAL THERAPY

Program Adviser: B. Loomis

Program Office: 505 East Green Street, Champaign

100. **Occupational Therapy Orientation.** Historical development of the profession and its evolving philosophies; the attitudes, concepts, and skills of the occupational therapist; and the relationship of occupational therapy to associated disciplines; includes required laboratory-field experiences. Prerequisite: Registration in occupational therapy curriculum. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.

PERSIAN

(See Linguistics under Humanities, School of)

PHILOSOPHY

(See Humanities, School of)

PHYSICAL EDUCATION

Head of Department: Professor R. G. Wright

Department Office: 117 Freer Gymnasium, Urbana

100. **Foundations of Physical Activity.** Activities and understanding of the human body relative to physical fitness and sport skill patterns. 1 hour.
101. **Prescribed Exercise.** Prescribed exercise adapted to individual needs, capacities, and interests. Open only to paraplegic and handicapped students. 1 hour. May be repeated to a maximum of 4 hours.
102. **Symbolism and Movement.** Analysis of movement as a science and art, and as a symbolic form of communication; creative exploration of movement as a concomitant element of theater and the concert stage. 1 hour.
103. **Physical Fitness.** Activities and understanding which contribute to the development and maintenance of physical fitness according to social and hygienic standards. 1 hour. May be repeated once for credit if taken in successive semesters.
104. **Weight Training.** Skills and knowledge essential for use of weights for conditioning the body. 1 hour. May be repeated once for credit if taken in successive semesters.
105. **Conditioning and Weight Control.** Activities and understanding which contribute to the development and/or maintenance of physical fitness and a well-proportioned body. 1 to 2 hours. May be repeated once for credit if taken in successive semesters; credit not to exceed a total of 2 hours.
107. **Personal Defense.** Skills and understanding essential for defense against an aggressor, with emphasis on avoiding attack. 1 hour.
110. **Wrestling.** Introductory skills, knowledge, and conditioning essential for collegiate wrestling. 1 hour.
114. **Tumbling.** Instruction in forward and backward rolls, inverted stunts, springs, aerial somersaults, aerial twisting somersaults, and transitional movements for free exercise routines. 1 hour. May be repeated once for credit.
115. **Trampoline.** Introductory skills, knowledge, and conditioning relative to trampolining and tumbling. 1 hour.
117. **Apparatus, I.** Introductory skills, knowledge, and conditioning relative to participation on heavy apparatus. 1 hour.
123. **Target Archery.** Introductory skills, knowledge, and conditioning essential for target shooting. 1 hour.
127. **Angling.** Introductory skills and understanding essential for bait, fly, and spin casting. 1 hour.
128. **Equitation and Horsemanship, I.** Fundamentals of riding, including walk, trot, and canter; flatsaddle and bareback riding; use of reins and tack; saddling and unsaddling; and basic grooming. For current fees, see *Timetable*. 1 hour.
134. **Ballroom Dance, I.** Introductory skills and understanding essential for basic ballroom dance steps; emphasis on waltz, swing, fox trot, rhumba, cha-cha, and polka. 1 hour.
135. **American Square Dance.** Introductory skills and understanding essential for square dancing; opportunities for conducting and calling dances. 1 hour.
136. **International Folk Dance.** Introductory skills, knowledge, and conditioning essential for exploring cultural characteristics via the folk dance idiom. 1 hour.
138. **Modern Dance, I.** Introductory skills, knowledge, and conditioning essential for free and creative dance. 1 hour.
139. **Ice Dance.** Introduction to set patterns of ice dance; emphasizes ice dance skills designed to build control in footwork and balance when skating with a partner. Prerequisite: Physical Education 215 or consent of instructor. 1 hour. May be repeated to a maximum of 2 hours.
140. **International Ballroom Dance.** Skills and understanding essential for international ballroom dance steps; emphasis on tango, cha-cha, Viennese waltz, samba, rhumba,

quickstep, paso doble, mambo, and merengue. Prerequisite: Physical Education 207 or consent of instructor. 1 hour.

143. **Bowling, I.** Introductory skills and understanding essential for bowling. 1 hour.
144. **Golf, I.** Introductory skills and understanding essential for course play, with emphasis on irons. 1 hour.
145. **Figure Skating, I.** Introductory skills, knowledge, and conditioning essential for figure skating. 1 hour.
147. **Snow Skiing, I.** Introductory skills, knowledge, and conditioning relative to snow skiing; practical experience will be accommodated at off-campus locations. For current fees, see *Timetable*. 1 or 2 hours. May be repeated to a maximum of 2 hours.
148. **Track and Field.** Introductory skills, knowledge, and conditioning essential for various track and field events. 1 hour. May be repeated once for credit.
153. **Badminton.** Introductory skills, knowledge, and conditioning essential for badminton. 1 hour.
154. **Foil Fencing.** Introductory skills, knowledge, and conditioning essential for foil fencing. 1 hour.
155. **Handball.** Introductory skills, knowledge, and conditioning essential for four-wall handball. 1 hour.
156. **Racquetball, I.** Introductory skills, knowledge, and strategies essential for racquetball. 1 hour.
157. **Squash Racquets.** Introductory skills, knowledge, and conditioning essential for squash racquets. 1 hour.
158. **Tennis, I.** Introductory skills, knowledge, and conditioning essential for court play. 1 hour.
159. **Rhythmic Gymnastics.** Dynamic rhythmic movement interpretation by individual and group structure; utilization of hand apparatus (balls, hoops, ropes, etc.). 1 hour. May be repeated once for credit.
163. **Basketball.** Introductory skills, knowledge, and conditioning essential for basketball. 1 hour.
164. **Volleyball, I.** Introductory skills, knowledge, and conditioning essential for power volleyball. 1 hour.
169. **Rugby Football.** Introductory skills, knowledge, and conditioning essential for offensive and defensive strategies of the game. 1 hour.
171. **Tackle Football, I.** Introductory skills, knowledge, and conditioning for tackle football. Prerequisite: Consent of instructor. 1 hour.
172. **Lacrosse.** Introductory skills, knowledge, and conditioning essential for lacrosse. 1 hour.
173. **Soccer.** Introductory skills, knowledge, and conditioning essential for soccer. 1 hour.
174. **Speedball and Speedaway.** Introductory skills, knowledge, and conditioning necessary for speedball and speedaway. 1 hour.
175. **Field Hockey.** Introductory skills, knowledge, and conditioning essential for field hockey. 1 hour.
176. **Ice Hockey.** Introductory skills, knowledge, and conditioning essential for ice hockey. 1 hour.
177. **Baseball, I.** Introductory skills, knowledge, and conditioning for baseball. 1 hour.
182. **Swimming, I.** Introductory skills, knowledge, and conditioning essential for swimming. Open only to nonswimmers and those with no deep water experience. 1 hour. May be repeated once for credit.
183. **Competitive Swimming.** Skills, knowledge, and conditioning essential for strokes, starts, and turns; emphasis on training for competitive participation as well as meet organization. Prerequisite: Physical Education 231 or consent of instructor. 1 hour.
184. **Springboard Diving.** Introductory skills, knowledge, and conditioning essential for springboard diving. Prerequisite: Physical Education 231 or consent of instructor. 1 unit. May be repeated once for credit.

185. **Synchronized Swimming, I.** Introductory skills, knowledge, and conditioning essential for creating aquatic compositions. Prerequisite: Physical Education 231 or consent of instructor. 1 hour.
186. **Water Polo, I.** Designed to develop skills, strategies, and knowledge essential for participation in the game of water polo. Prerequisite: Physical Education 183 or consent of instructor. 1 hour.
188. **Life Saving.** American Red Cross training for the prevention of aquatic mishaps and for life saving. Prerequisite: Ability to swim one-half mile including 20 yards underwater and 100 yards of each of the following: sidestroke, breaststroke, and front crawl. 2 hours.
190. **Water Safety Instructor Training.** American Red Cross Instructor training for the teaching of swimming and life saving. Prerequisite: Physical Education 231 or consent of instructor; a Red Cross Senior Life Saving authorization card. 2 hours.
193. **Canoeing.** Introductory skills and knowledge essential for handling a canoe with safety. Prerequisite: Physical Education 231 or consent of instructor; the ability to jump or dive into deep water while clothed and maintain a survival position for 10 minutes. 1 hour.
194. **SCUBA Diving, I.** Introductory skills, knowledge, and conditioning essential for SCUBA diving. A certification card will be issued upon successful completion of the course. Prerequisite: Physical Education 231 or consent of instructor; medical certification. For current fees, see *Timetable*. 2 hours.
197. **Equitation and Horsemanship, II.** Intermediate riding skills, including individual control of walk, trot, and canter; smooth transfer of gaits; bareback riding in all three gaits; diagonals, figure eights, and serpentine; and tack maintenance. For current fees, see *Timetable*. Prerequisite: Physical Education 128 or consent of instructor. 1 hour.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Apparatus, II.** Intermediate skills, knowledge, and conditioning relative to participation on heavy apparatus. Prerequisite: Physical Education 117 or consent of instructor. 1 hour.
207. **Ballroom Dance, II.** Skills for intermediate ballroom dance steps; emphasis on waltz, swing, fox trot, rumba, cha-cha, tango, samba, and Viennese waltz. Prerequisite: Physical Education 134 or consent of instructor. 1 hour.
211. **Modern Dance, II.** Intermediate level technique, improvisation, and composition for both men and women; multimedia approaches to dance and dance criticism. Prerequisite: Physical Education 138 or consent of instructor. 1 hour.
213. **Bowling, II.** Intermediate skills and understanding essential for bowling. Prerequisite: Physical Education 143 or consent of instructor. 1 hour.
214. **Golf, II.** Intermediate skills and understanding essential for use of irons and woods; analysis of course play. Prerequisite: Physical Education 144 or consent of instructor. 1 hour.
215. **Figure Skating, II.** Intermediate skills, knowledge, and conditioning essential for figure skating, with emphasis on skills to pass the United States Figure Skating Association's preliminary tests. Prerequisite: Physical Education 145 or consent of instructor. 1 hour.
216. **Figure Skating, III.** Advanced skills, knowledge, and conditioning essential for figure skating, with emphasis on skills to pass the first eight tests of the United States Figure Skating Association. Prerequisite: Physical Education 215 or consent of instructor. 1 hour.
221. **Racquetball, II.** Intermediate skills, knowledge, and strategies essential for racquetball. Prerequisite: Physical Education 156 or consent of instructor. 1 hour.
223. **Tennis, II.** Intermediate skills, knowledge, and attitudes for effective court play. Prerequisite: Physical Education 158 or consent of instructor. 1 hour.
225. **Baseball, II.** Intermediate and advanced skills, knowledge, and conditioning for baseball. Prerequisite: Physical Education 177 or consent of instructor. 1 hour. May be repeated to a maximum of 2 hours.

227. **Tackle Football, II.** Intermediate and advanced skills and knowledge for tackle football; emphasizes team formations and strategies. Prerequisite: Physical Education 171 or consent of instructor. 1 hour. May be repeated to a maximum of 2 hours.
228. **Volleyball, II.** Intermediate skills, knowledge, and conditioning essential for power volleyball. Prerequisite: Physical Education 164 or consent of instructor. 1 hour.
231. **Swimming, II.** Intermediate skills, knowledge, and conditioning essential for swimming. Open only to swimmers who can execute a minimum of one of the five basic strokes in deep water, perform a standing dive, and tread in deep water. Prerequisite: Physical Education 182 or consent of instructor. 1 hour.
233. **Synchronized Swimming, II.** Skills and knowledge at the intermediate level for creating aquatic compositions with an emphasis on choreography. Prerequisite: Physical Education 185 or consent of instructor. 1 hour.
235. **SCUBA Diving, II.** Intermediate and advanced skills gained through dives at various off-campus locations; successful completion of the course leads to an advanced diver's certification. For current fees, see *Timetable*. Students will be expected to provide their own basic equipment. Prerequisite: Physical Education 194 or consent of instructor; current certification card and medical certification. 2 hours.
239. **Performance and Analysis of Physical Activities.** Introduction to the development of motor skills in selected physical activities; emphasis on the analysis of performance and developmental sequence as determined by different age groups, body build, and sex factors. Understanding is gained through activity, field trips, and seminars. 3 hours.
240. **Social Scientific Bases of Sport.** Introduction to the social science aspects of physical education and sport; particular emphasis on concepts derived from the social sciences (including psychology) that are appropriate to physical education and sport. 3 hours.
241. **History of Sport.** Deals principally with the social, cultural, and economic aspects of the sport movement in the Western world; secondary emphasis on methods of historical research. 3 hours.
244. **Anthropology of Play.** Same as Anthropology 244. The study of human play with emphasis on origin, diffusion, spontaneity, emergence, and diversity; includes functions of play in selected culture groups. Prerequisite: A course in anthropology. 3 hours.
249. **Sport and Modern Society.** The sociological analysis of sport in modern societies with regard to social class, politics, community, education, and collective behavior. 3 hours.
250. **Bioscientific Foundations of Man Moving.** Introduction to the anatomical, physiological, and biomechanical principles of human movement; particular emphasis on developing concepts of how the body moves, movement awareness, environmental determinants, exercise stress, physical conditioning, kinesiotherapy, and physical fitness. 3 hours.
251. **Theory of Prescribing Exercise.** Prescription and conduct of recreational and exercise programs for selected physical handicaps. Prerequisite: Physiology 103 and 234. 3 hours.
252. **Prevention and Care of Athletic Injuries.** Diagnostic procedures, massage, taping, bandaging, hydrotherapy, electrotherapy, handling emergency conditions, training quarters, facilities, and hygiene. Prerequisite: Physiology 103 and 234. 3 hours.
260. **Physical Education as a Profession.** The nature and scope of physical education as a profession; emphasis on orientation to the profession as well as understanding necessary for selecting an area of specialization within physical education. 2 hours.
261. **Rhythmics and Gymnastique Moderne.** Rhythmics, including the analysis and synthesis of various locomotor rhythmic patterns; basic principles and techniques of modern gymnastics, including dynamic rhythmic movements, such as movements with hand apparatus (balls, clubs, hoops, ribbons, and ropes) performed individually and as a group. 2 hours.
262. **Motor Development in Childhood.** Same as Home Economics 204. Study of the selection of specific movement experiences for the elicitation and maintenance of developmental sequences in children and youths based on physical growth and motor develop-

ment; observational experiences provided with children in a variety of settings. Prerequisite: Physical Education 250 or Home Economics 105. 3 hours.

263. **Curriculum Development in Elementary School Physical Education.** Identification, selection, and organization of movement experiences appropriate for elementary school-age children (K-6); emphasis on concept development and integration with total elementary school curriculum. Prerequisite: Physical Education 262 or consent of instructor. 2 hours.
264. **Organization and Administration of Physical Education.** The scope of this course is concerned with the organization and administration of a total physical education program, including administrative philosophy; the physical education program; physical education staff, facilities, and equipment; the budgetary process; legal liability; discipline; and public relations. 3 hours.
265. **Fitness Programs.** This course includes subject matter related to the "why" and "how" of physical activity; lectures provide an introduction to the physiology of exercise; and practical work includes physical fitness tests, calisthenics, and leadership techniques in a physical education class. 2 hours.
266. **Basic Movement and Body Mechanics.** Experiences, skills, and knowledge relative to structure and function of the human body in selected physical education and dance activities. 1 hour.
269. **Physical Education for the Classroom Teacher.** Curriculum, methods, and organization of physical education in the elementary school. For non-physical education majors. It is recommended that students in Physical Education 269 enroll concurrently in Elementary and Early Childhood Education 237 for the purpose of facilitating observation and/or teaching children in the elementary schools. Prerequisite: Junior standing. 3 hours.
270. **Principles of Evaluation and Assessment.** An introduction to the methods and techniques of evaluation and assessment of human performance in physical education and sport. Prerequisite: Physical Education 260; Mathematics 111 or 112, or equivalent score on the Mathematics Placement Test. 3 hours.
271. **Administration of High School Sport Programs.** Organization of sports programs, team sports, intramural programs, and recreational sports programs. 3 hours.
272. **Organization of Aquatic Programs.** Same as Leisure Studies 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; and operational records. 2 hours.
273. **Instructional Strategies in Physical Education.** Knowledge of the teaching-learning process and performance outcomes transmitted into instructional strategies; emphasis on the identification of strategies specific to skill development in physical education activities. Prerequisite: Physical Education 282; concurrent registration in an instructional strategies course in a specific activity area. 1 hour.
275. **Instructional Strategies in Social Dance Forms.** Instructional strategies for teaching ballroom, folk, and American square dance. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in ballroom or folk dance. 2 hours.
276. **Instructional Strategies in Gymnastics.** Instructional strategies for the teaching of gymnastics. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in apparatus or tumbling. 2 hours.
277. **Instructional Strategies in Small Group Activities.** Instructional strategies for the teaching of small group activities; special emphasis given to skill acquisition, development and recognition of offensive and defensive systems, and discussion of motivational and instructional agents which facilitate performance. Prerequisite: Credit or concurrent registration in Physical Education 273; credit in a small group activity at intermediate level of skill. 2 hours.
278. **Instructional Strategies in Large Group Activities.** Instructional strategies for the teaching of large group activities; special emphasis given to techniques of skill acquisition, development and recognition of offensive and defensive systems, and discussion of

motivational and instructional agents which facilitate performance. Prerequisite: Physical Education 273; credit in a large group activity at intermediate level of skill. 2 hours.

279. **Instructional Strategies in Swimming.** Instructional strategies for the teaching of swimming. Prerequisite: Credit or concurrent registration in Physical Education 273; intermediate skill level in swimming. 2 hours.
282. **Psychology of Learning and Teaching Physical Education.** Physical education knowledge applied to teaching methodology in the learning process; special emphasis on the identification and assimilation of the interdependency of physical education goals, transmission process, and performance outcomes specific to elementary and secondary physical education. Prerequisite: Physical Education 239, 250, and 260; or consent of instructor. 3 hours.
285. **Supervised Experiences in Physical Education Research.** Supervised laboratory experiences in physical education research; individual work under the supervision of members of the faculty in their respective fields. The student assists with data collection, processing, and analysis for research in progress. Prerequisite: Physical Education 260 or consent of instructor. 3 hours. May be repeated to a maximum of 6 hours.
286. **Supervised Experience in the Common School.** Supervised practice in observing, assisting, and teaching children in preelementary school, elementary school, junior high school, and senior high school; emphasis on understanding motor behavior, teacher-learner behavior, and interrelatedness with other aspects of the learning environment. Prerequisite: Physical Education 282 or equivalent. 3 hours. May be repeated for a maximum of 6 hours.
287. **Supervised Experiences in the Agency Setting.** Supervised practical experience in physical education leadership roles in nonschool agency settings; emphasis on observing, planning, and conducting physical activity programs for children and/or adults in preschool, recreation, or other social agencies. Prerequisite: Physical Education 282 or equivalent. 3 hours. May be repeated for a maximum of 6 hours.
290. **Honors Seminar.** Same as Health Education 260 and Leisure Studies 260. Lectures and discussion dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty advisor, instructor, and head of department. 2 hours. May be repeated for a maximum of 6 hours.
291. **Special Problems.** Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the students. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty advisor, instructor, and head of department. 2 or 3 hours. May be repeated for a maximum of 4 to 6 hours.
292. **Advanced Football.** Offensive and defensive strategy; training drills. 1 hour.
293. **Advanced Basketball.** Offensive and defensive strategy; training drills. 1 hour.
294. **Advanced Gymnastics.** Involves the review of basic skills and study of advanced skills, and leads to qualification as an instructor of gymnastics at the elementary, secondary, and college levels; includes methods of teaching, safety devices and practices, and practical learning of progressions for the several gymnastics events. Prerequisite: Consent of instructor. 2 hours.
295. **Advanced Wrestling.** Designed to review the basic skills and to introduce more advanced wrestling techniques and strategies, thereby preparing better qualified wrestling instructors and coaches for the various educational levels. Prerequisite: Consent of instructor. 2 hours.
296. **Theory of Coaching.** Basketball, football, and baseball schedule making; team management; scouting; and officiating. Prerequisite: Consent of instructor. 2 hours.
305. **Principles of Ergonomics.** Same as Industrial Engineering and Physiology 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work; consideration of such topics as static and dynamic forces on the human frame, responses to environmental stress (heat, vibration, noise), vigilance and fatigue, and man-

- machine systems. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.
- 306. Quantitative Methods in Ergonomics.** Same as Industrial Engineering and Physiology 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments; familiarization with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair, and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.
- 341. International Physical Education and Sport.** A study of objectives, methods, personnel, facilities, and evaluation of selected national programs of physical education; additional consideration given to sports clubs, indigenous games, and research. Prerequisite: Physical Education 241 or consent of instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
- 343. Social Psychology and Motor Behavior.** Same as Leisure Studies 343. The use of social psychological theory and methods in the study of motor behavior; emphasis given to the influence of social psychological processes on motor skill acquisition, including such variables as social facilitation, competition, aggression, attitudes, and personality. Prerequisite: Educational Psychology 390; Psychology 201; or consent of instructor. 4 hours or 1 unit.
- 348. Social Problems Related to Physical Activity and Sport.** Same as Leisure Studies 348. A seminar with field study on physical activity and sport for marginal, deviant, or sociopsychologically deprived groups. Prerequisite: Six hours in the social sciences or consent of the instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
- 349. Analysis of Small Groups in Play or Sport.** Same as Leisure Studies 349. The methodology of small group research and analysis of the small group in play and sport; culture, social structure, and personality structure in the group; and class and student observation and analysis of the small group in play and sport in natural field settings. Prerequisite: Psychology 100 or 201, or Sociology 100 or 201, or consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
- 350. Theory and Practice of Exercise Therapy.** Theory and practice of therapeutic exercise as it applies to physical rehabilitation of the physically handicapped; physiological and kinesiological principles of physical restoration; physical educator's role as related to ancillary medical forces; and problems and principles related to kinesiotherapy, preventive, adapted, and remedial physical education, and athletic training. Prerequisite: Physiology 103 and 234; Physical Education 250 and 355; or consent of instructor. 4 hours, or $\frac{1}{2}$ or 1 unit.
- 352. Physiology of Physical Activity.** Study of the immediate and long-term physiological effects of exercise upon the body; mechanisms of neuromuscular, cardiorespiratory, and metabolic control and adaptation relative to physical activity. Laboratory and lecture. Prerequisite: Physical Education 250; Physiology 103 and 234; or equivalent. 3 hours or 1 unit.
- 354. Growth and Physical Development of Children.** Same as Home Economics 354. A study of the growth and physical development of children through adolescence with emphasis on those systems and body composition changes related to motor performance and exercise stress. Prerequisite: Physiology 103 and 234; Physical Education 270; or equivalent. 3 hours or 1 unit.
- 355. Kinesiology.** The scientific study of the anatomical and biomechanical principles of human performance; utilization of cinematography and electromyography in the analysis of selected physical education activities. Prerequisite: Physical Education 250 or equivalent; Physiology 234 or equivalent; Mathematics 104 or equivalent; or consent of instructor. 3 hours or 1 unit.
- 357. Motor Learning.** Discussion and analysis of scientific principles related to the learning and performance of motor skills; review of related literature and research in motor learning. Prerequisite: Psychology 100 or consent of instructor. 4 hours or 1 unit.

362. **Advanced Athletic Training Techniques.** Provides in-depth knowledge and skill in athletic training, including experience in prescribed athletic training duties; techniques and research in the prevention, care, treatment, and rehabilitation of athletic injuries. Prerequisite: Physical Education 252 or consent of instructor. 3 hours or 1 unit.
363. **Curriculum Development and Trends.** Curriculum planning and development in physical education with emphasis on ecological, biological, psychological, and sociological factors influencing programs in schools and colleges. Prerequisite: Physical Education 264 or consent of instructor. 4 hours or 1 unit.
364. **Problems of Facilities Planning, Construction, and Utilization.** Physical education facilities as related to objectives of physical education; consultant services with planning committees and architects; cost factors in different types of construction; the use of standards as a check on and guide for planning; safety factors; changes in playing surfaces due to research; and building and fields maintenance programs. Prerequisite: Physical Education 264 or equivalent, or consent of instructor. 2 hours, or $\frac{1}{2}$ or 1 unit.
365. **Movement Notation.** Scientific symbolic system for notation of movements of the human body. Prerequisite: Physical Education 250 or 355, or Dance 160. 3 hours or 1 unit.
394. **Special Topics in Physical Education.** Lecture course on topics of current interest; specific topics announced in the *Timetable*. Prerequisite: To be determined for each subject and indicated in the *Timetable*. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated.
440. **History of Physical Education and Sport.** An analysis of the research literature related to the historical foundations of physical education and sport; discussion of such persistent historical problems as the influence of economics, politics, and nationalism; curriculum and methods of instruction; professional preparation; the healthy body; dance; the use of leisure; and amateur and professional sport. Prerequisite: Physical Education 241 or equivalent. 1 unit.
441. **Philosophy of Physical Education and Sport.** Philosophical analysis of physical education and sport (with some reference to school health and recreation) in the light of the leading philosophical tendencies and possible implications for public and private education; analysis of completed research; and delineation of one's personal philosophy and the use of philosophical analysis as a research technique. Prerequisite: Philosophy 101; History and Philosophy of Education 305. 1 unit.
443. **Group Dynamics in Sport.** Same as Leisure Studies 443. Theories and methods in the study of the psychology of small group behavior in sport; analysis of the literature pertaining to group structure and group processes, with particular emphasis on group performance in sport. Prerequisite: Physical Education 343 or consent of instructor. 1 unit.
447. **Sport Psychology.** Analysis of psychological factors and principles with special reference to motor performance, learning motor skills, perception, and emotion in sports situations; review of literature; and independent projects. Prerequisite: Psychology 100; Educational Psychology 211; consent of instructor. 1 unit.
449. **The Sociology of Sport.** Same as Sociology 449. Sociological analysis of sport with emphasis on sociological theory; sport and games in cross-cultural analysis; sport's structure and function in modern industrialized society; the system of sport in regard to its role structure, formal organization, and professionalization; its differentiation along social class, age, and sex; and sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
451. **Scientific Basis of Physical Performance.** Contemporary trends in the study of human performance and exercise stress; analysis of the research literature, experimental strategies, and research instrumentation. Lecture-discussion and laboratory. Prerequisite: Physical Education 352 or 354; Physical Education 355; or equivalent. 1 unit.
452. **Neuromuscular Aspects of Human Performance.** In-depth study of the neuromuscular aspects of human activity; focus on selected topics related to growth, physical development, exercise prescriptions, athletic conditioning, and fitness. Lecture-discussion and laboratory. Prerequisite: Physical Education 451. 1 unit.

453. **Circulorespiratory Aspects of Physical Activity.** Aerobic performance responses to short-term, intermittent, and prolonged physical activity; special consideration given to endurance training methods and assessment techniques, ergogenic aids, and problems associated with growth, environmental influences, and competitive sport. Lecture-discussion and laboratory. Prerequisite: Physical Education 451 or consent of instructor. 1 unit.
455. **Experimental Kinesiology.** Mechanical and neuromuscular approach to human movement; analysis, experimental research findings, and lecture and laboratory discussions. Prerequisite: Physiology 234 or equivalent; Physical Education 355 or equivalent; or consent of instructor. 1 unit.
457. **Sensorimotor Development.** Same as Home Economics 457. Study of the development of spatially adapted movement behavior in man; emphasis on the nature of sensorimotor systems and development of perception; the role of proprioceptive feedback mechanisms and associated reflexes; and the neurogeometric principles basic to the study of man interpreting and acting on the environment. Prerequisite: Physical Education 357 or equivalent. 1 unit.
459. **Principles of Kinesiotherapy.** Analysis of medically approved techniques employed in the treatment of disease and injury by exercise and movement; kinesiological evaluation of principles involved; therapy preparation in teaching techniques; medically prescribed clinical training; and literature and research. Prerequisite: Physiology 234; Physical Education 250 and 355; or consent of instructor. 1 unit.
461. **Administration of Physical Education and Sport.** Analysis of completed research relating to theory and practice of administration in physical education and sport; the development of policy statements and procedures manuals for the various educational levels; and experience in the use of the case plan of instruction as a teaching technique for the development of competence and knowledge relating to human relations and administration in this specialized field. Prerequisite: Physical Education 264 or equivalent. 1 unit.
473. **Ergonomics Seminar.** Same as Industrial Engineering 473 and Physiology 473. In-depth exploration of topics in ergonomics, such as effects of vibration on human performance, biomechanics of the hand, and functional dimension. Prerequisite: Physical Education 306. ½ unit.
490. **Seminar.** Lectures, discussions, and critiques on physical education and related subjects by faculty members and visiting professional leaders; presentation and criticism of student theses. 0 credit.
493. **Independent Study.** Independent research on special projects; offered summers as a special group practicum. ½ or 1 unit.
494. **Special Topics in Physical Education.** Lecture course in topics of current interest; specific subject matter announced in the *Timetable*. ½ or 1 unit. May be repeated.
495. **Techniques of Research in Health, Physical Education, and Recreation.** Review and appraisal of common research procedures; application of statistical procedures, library methods, evaluation procedures, and experimental methods. 1 unit.
499. **Thesis Research.** Preparation of theses in physical education. 0 to 4 units.

PHYSICS

Head of Department: Professor R. O. Simmons

Department Office: 211 Physics Building, Urbana

101. **General Physics (Mechanics, Heat, and Sound).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Trigonometry. 5 hours.

102. **General Physics (Light, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences, architecture, agriculture, and veterinary medicine. Prerequisite: Physics 101. 5 hours.
106. **General Physics (Mechanics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Mathematics 120; credit or concurrent registration in Mathematics 130 or 131. 4 hours.
107. **General Physics (Heat, Electricity, and Magnetism).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 106; credit or concurrent registration in Mathematics 140 or 141. 4 hours.
108. **General Physics (Wave Motion, Sound, Light, and Modern Physics).** Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 107; credit or concurrent registration in Mathematics 140 or 141. 4 hours.
140. **Practical Physics: How Things Work--A Course for Nonscientists.** A nonmathematical lecture-demonstration course for nonscience students, underscoring the generality and ubiquity of basic physical laws in understanding commonplace phenomena: musical instruments, photography, electric and electronic circuits, television, motors, engines, etc. 3 hours. No credit for students in the College of Engineering.
141. **Special Problems.** Special problems in physics: discussions and independent study. Supplement to Physics 140. Prerequisite: Credit or concurrent registration in Physics 140. 1 hour.
150. **Physics and the Modern World: A Course for Nonscientists.** A nonmathematical lecture course attempting to bridge the two-culture gap; takes examples from modern physics: relativity, elementary particles, quantum theory, statistics, etc., and covers basic philosophical concepts in physics which pervade all human disciplines: model-making, dynamics, ensemble behavior, and symmetry. 3 hours.
151. **Special Problems.** Special problems in physics: discussions and independent study. Supplement to Physics 150. Prerequisite: Credit or concurrent registration in Physics 150. 1 hour.
170. **Physics of Photography.** Designed to enable nonscience students to understand photography. The nature of light, including reflection and refraction; how lenses work and why they are imperfect; the formation of the latent image in the film and the development of the image; light sources; color photography; and special topics. Includes laboratory experiments. Prerequisite: High school algebra and geometry. 4 hours. No credit for students in the College of Engineering.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
302. **Principles of Atmospheric Dynamics.** Same as Atmospheric Sciences 302. An introduction to those elements of fluid dynamics and thermodynamics which are essential to understanding the large- and small-scale motions of the neutral atmosphere. Prerequisite: Mathematics 343; consent of instructor. 4 hours or 1 unit.
303. **Modern Experimental Physics, I.** Techniques and experiments in the physics of atoms, atomic nuclei, molecules, the solid state, and other areas of modern physical research. Prerequisite: Physics 342; credit or concurrent registration in Physics 386. 3 to 5 hours, or $\frac{1}{2}$ to 1 unit. Students taking the course for the first time must register for 5 hours or 1 unit. Those repeating the course may do so for variable credit of 3 to 5 hours, or $\frac{1}{2}$ to 1 unit.
321. **Theoretical Mechanics.** Motion of a particle in one, two, and three dimensions, with applications; Kepler's laws and planetary motion; scattering of particles; conservation laws; motion of a rigid body in two dimensions; statics of extended systems; and lectures and problems. Prerequisite: General physics; credit or concurrent registration in Mathematics 341, 345, or 349. 4 hours or 1 unit. No graduate credit for graduate physics majors.

- 322. Theoretical Mechanics.** Continuation of Physics 321. Moving coordinate frames and fictitious forces; special theory of relativity, conservation laws, and particle motion and creation; rigid body motion in three dimensions; gravitation and earth motion; generalized coordinates and Lagrange's equations; and constraints and small vibrations. Prerequisite: Physics 321. 4 hours or 1 unit.
- 341. Intermediate Electricity and Magnetism, I.** Basic laws of electricity and magnetism; emphasis on vector methods; electric fields, potential, capacitance, and dielectrics; conductors, magnetic fields, and magnetic induction; inductance, transients in RL, RC, and RLC circuits; and linear response theory. Lectures, problems, and laboratory. Prerequisite: Two semesters of general physics; concurrent registration in Mathematics 341, 343, or 345; or consent of instructor. 5 hours, or $\frac{3}{4}$ or 1 unit ($\frac{3}{4}$ unit without laboratory). No graduate credit to graduate physics majors.
- 342. Intermediate Electricity and Magnetism, II.** Continuation of Physics 341; applications of the basic laws; magnetostatics, boundary conditions, Ampere's law for magnetic media, magnetostatic energy and force, magnetic materials, AC circuits, filters, transmission lines; and wave propagation in dielectrics and conductors, waveguides, cavities, and radiation from antennas. Lectures, problems, and laboratory. Prerequisite: Physics 341. 5 hours, or $\frac{3}{4}$ or 1 unit ($\frac{3}{4}$ unit without laboratory). No graduate credit to graduate physics majors.
- 343. Electronic Circuits, I.** The physics of semiconductor devices; theory and application of discrete and integrated devices in linear circuits; use of operational amplifiers and feedback; regulation, oscillators, and modulation; and emphasis on practical experience. Lectures, problems, and laboratory. Prerequisite: Physics 341 or consent of instructor. 5 hours or 1 unit.
- 344. Electronic Circuits, II.** Continuation of Physics 343 with particular emphasis on nonlinear devices, switching circuits, digital logic, analog to digital and digital to analog conversion, and individual projects. Lectures, problems, and laboratory. Prerequisite: Physics 343 or consent of instructor. 5 hours or 1 unit.
- 346. Modern Physics for Nuclear Engineers.** Same as Nuclear Engineering 346. Those fundamentals of quantum theory, atomic structure, and nuclear behavior needed by students before taking advanced courses in nuclear engineering; basic information on radiation types, properties, and interactions. Prerequisite: Junior standing in engineering or physical science. 3 hours or $\frac{3}{4}$ unit.
- 360. Thermodynamics.** Zeroth, first, second, and third laws of thermodynamics; applications to simple physical and chemical systems; thermodynamic inequalities and equilibrium; and phase transitions. Lectures and problems. Prerequisite: General physics and calculus; senior standing in physics advised. 4 hours or 1 unit.
- 362. Statistical Physics.** A lecture and problem course introducing the fundamentals of classical and quantum statistical mechanics and their applications; topics covered include probability, classical statistical mechanics, kinetic theory, Fermi-Dirac and Bose-Einstein statistics with elementary examples, statistical thermodynamics, fluctuations and irreversible processes, and thermoelectric effects. Prerequisite: Physics 360 or consent of instructor. 4 hours or 1 unit. Students may not receive credit for both Physics 362 and Mechanical Engineering 301.
- 365. Introduction to Plasma Physics.** Physical concepts underlying the description of ionized gases; individual particle and continuum models; collision processes in plasmas; charged particle motion in electromagnetic fields; waves in cold plasmas; elementary treatment of collective plasma behavior; simple plasma instabilities; and selected topics of current interest. Prerequisite: Electrical Engineering 350 or Physics 342, or consent of instructor. 4 hours or 1 unit.
- 371. Light.** Wave kinematics; geometrical optics: basic concepts, ray-tracing and matrix formalism, Gaussian imaging by thick lenses, stops, and apertures, and intensity relations; interference; interference spectroscopy and coherence; diffraction: Fresnel-Kirchhoff formulation, Fraunhofer case, Fresnel case, and holography; and polarized

- light. Lectures, laboratory, and problems. Prerequisite: Physics 101 and 102, or Physics 106, 107, and 108; Mathematics 345; or consent of instructor. 4 hours, or $\frac{1}{2}$ or 1 unit.
382. **Subatomic Physics.** A lecture and problem course surveying subatomic physics; includes the nature and properties of nuclei and elementary particles, symmetries, interactions, nuclear models, tools and techniques of experimental subatomic physics, and applications to power generation, astrophysics, chemistry, medicine, and biology. Prerequisite: Physics 383, 385, or 386, or consent of instructor. 4 hours or 1 unit.
383. **Atomic Physics and Quantum Theory.** Introduction to the basic concepts of quantum theory which underlie modern theories of the properties of materials; topics covered include elements of atomic and nuclear theory; kinetic theory and statistical mechanics; quantum theory and simple applications; atomic spectra and atomic structure; molecular structure and chemical binding. Lectures and problems. Prerequisite: General physics; general chemistry; Mathematics 345 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.
386. **Atomic Physics and Quantum Mechanics, I.** Study of atomic phenomena integrated with an introduction to quantum theory; discussion of topics including evidence for the atomic nature of matter and the properties of the Schrodinger equation, single particle solutions in one dimension, the hydrogen atom, perturbation theory, external fields, and atomic spectroscopy of outer electrons. Prerequisite: General physics; Mathematics 343 or 345, or consent of instructor. 4 hours or 1 unit.
387. **Atomic Physics and Quantum Mechanics, II.** Continuation of Physics 386. Topics treated include identical particles; spectral hyperfine structure; magnetic properties of matter; atomic spectroscopy of inner electrons; high-energy photon effects; molecular binding and spectra; emission and absorption of light; and symmetry principles. Prerequisite: Physics 386. 4 hours or 1 unit.
389. **Introduction to Solid State Physics.** Bonding and structure of crystals; energy bands in insulators, semiconductors, and metals; electrical conductivity; optical properties; lattice vibrations; elasticity; point defects; and dislocations. Prerequisite: Junior standing in science or engineering, or equivalent. 4 hours or 1 unit.
397. **Individual Study.** Individual study at an advanced level in a subject not covered by course offerings. Prerequisite: Upperclassman; consent of adviser and staff member who supervises the work. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit. May be repeated once.
398. **Seminar on Special Topics in Modern Physics.** Lecture course on topics of current interest in physics. For advanced undergraduates or graduates. Subjects and prerequisites to be announced in the *Timetable*. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.
402. **Theoretical Astrophysics.** Same as Astronomy 402. Application of physical principles to selected topics in astrophysics, including stellar structure and evolution, neutron stars and pulsars, cosmic electrodynamics, and cosmological problems; emphasis on the physics involved rather than on detailed factual description. Prerequisite: Physics 342 or 386, or consent of instructor. 1 unit.
404. **Stellar Structure and Evolution.** Same as Astronomy 404. Relationship between observable features of stars and the physical processes that occur in their interiors; topics include matter and radiation in stars: equations of state, modes of energy flow, nuclear energy production, and element synthesis; structure of stars during all phases prior to the supernova or planetary nebula stage; stellar pulsations with reference to Cepheids and RR Lyrae variables; and properties of white dwarfs, neutron stars, and contact binaries. Prerequisite: Physics 360 and 382; or Physics 402; or consent of instructor. 1 unit.
405. **Theory of the Interstellar Medium.** Same as Astronomy 405. Interstellar gas: balance of microscopic processes, large scale structure, interaction with stars, dynamics, heating, ionization, and cooling; continuous and discrete radiation processes, excitation mechanisms, propagation of radiation, molecule formation, dust grains, star formation, magnetic fields, and cosmic rays. Prerequisite: Consent of instructor. 1 unit.
411. **Special Functions and Boundary Value Problems in Physics.** Use of special functions in solving homogeneous partial differential equations of physics; emphasis on applications to topics such as electrostatics, wave guides and resonant cavities, vibrations of

- membranes, heat flow, and potential flow in fluids. Prerequisite: Mathematics 343 and 345, or equivalent. This course may be taken concurrently with Physics 413 or 414. $\frac{1}{2}$ unit.
- 412. Additional Techniques of Mathematical Physics.** Solution of inhomogeneous differential equations with particular emphasis on problems in electromagnetism; additional topics such as perturbation theory, variational methods, and integral equations; and emphasis on application of the techniques to nonquantum physics problems. Prerequisite: Physics 411 or equivalent. This course may be taken concurrently with Physics 413 or Physics 414. $\frac{1}{2}$ unit.
- 413. Uses of Complex Variables in Physics.** A review of complex variable theory, with emphasis on calculations useful to physicists; integration, conformal mapping, Laplace and Fourier transforms, and additional topics of use in theoretical physics. Prerequisite: Undergraduate mathematics at the level of Mathematics 343 and 345; some previous exposure to complex variables helpful, but not required. $\frac{1}{2}$ unit.
- 414. Basics of Advanced Mechanics.** Fundamentals of classical Lagrangian and Hamiltonian mechanics, with emphasis on the relation between dynamical symmetries and constants of the motion; use of conservation laws to derive basic equations of fluid dynamics; and discussion of some applications. Prerequisite: Mechanics at the level of Physics 322 or consent of instructor. $\frac{1}{2}$ unit.
- 424. General Relativity and Cosmology.** Same as Astronomy 424 and Mathematics 460. Foundations of general relativity and applications to problems of astrophysics; includes gravitation as geometry, mathematical tools, Einstein's equations, relativistic stellar structure, black holes and gravitational collapse, cosmology, gravitational radiation, and experimental tests. Prerequisite: Physics 322, 411, 412, and 442, or equivalent; or consent of instructor. 1 unit.
- 430. Surface Physics.** Same as Metallurgical Engineering 430. Introduction to theory and experiment on atomic behavior of crystal surfaces; thermodynamics of surfaces; surface energy; diffraction and structure; gas-solid collisions; Brownian motion, and diffusion and evaporation; electron and ion emission, and tunnelling; Van der Waals forces; theory of chemical interactions; and kinetics and statistics of absorption. Prerequisite: Metallurgical Engineering 421 or Physics 489, or consent of instructor. 1 unit.
- 435. Theory of Semiconductors and Semiconductor Devices.** Same as Electrical Engineering 435. Introductory quantum mechanics of semiconductors; energy bands; dynamics of Bloch electrons in static and high frequency electric and magnetic fields; equilibrium statistics; transport theory, diffusion, drift and thermoelectric effects; and characteristics of p-n junctions, heterojunctions, and transistor devices. Prerequisite: Senior-level course in quantum mechanics or atomic physics. 1 unit.
- 442. Classical Electromagnetic Radiation.** A review of Maxwell's equations followed by a relativistic formulation of the electromagnetic field and the motion of charged particles; plane and guided waves; retarded potentials; radiation from simple antennas; radiation from accelerated charged particles; and synchrotron radiation, bremsstrahlung, scattering, and further topics. Prerequisite: Physics 411 and 412, or equivalent; electromagnetism at the level of Physics 341 and 342; special relativity at the level of Physics 322. 1 unit.
- 455. Reactor Physics, I.** Same as Nuclear Engineering 455. Introduction to the physical concepts of reactor analysis; nuclear cross sections, diffusion, slowing down, and thermalization of neutrons; homogeneous reactor theory; introduction to heterogeneous reactor theory and reactor kinetics; and computer applications in reactor analysis. Prerequisite: Nuclear Engineering 355 or equivalent, or consent of instructor. 1 unit.
- 456. Reactor Physics, II.** Same as Nuclear Engineering 456. Continuation of Physics 455. Neutron transport theory; current methods of solution of the transport equation; fast and thermal neutron spectra; applications in heterogeneous reactor analysis and other areas of reactor physics; and digital computer methods. Prerequisite: Physics 455 or consent of instructor. 1 unit.

- 462. Statistical Mechanics and Kinetic Theory.** Single-particle distribution functions: classical and quantum mechanical systems, Boltzmann equation, virial theorem, and equations of state for gases; formal theory: ensembles, identical particles, thermodynamics of simple systems, and distribution functions; nonequilibrium problems; conservation laws and hydrodynamics equations, sound waves, and transport coefficients; and plasmas, normal Fermi fluid, superfluids, and systems with internal degrees of freedom. Prerequisite: Physics 360 and elementary quantum mechanics, or consent of instructor. 1 unit.
- 463. Low Temperature Theory and Quantum Liquids.** Normal Fermi liquids: equilibrium properties, transport equation, quasi-particle collisions, degenerate He, and Landau theory; formal description of experimental measurements in neutral and charged Fermi liquids; superfluid Bose liquid: He II, rotating buckets, macroscopic description of superfluid flow, two-fluid model, first, second, and quasi-particle sound, vortex lines, and microscopic theory; and superconductivity: BCS theory, electrodynamics and coherence effects, superconductivity in metals, tunnel effect, flux quantization, microscopic theory of superfluid flow, and vortices. Prerequisite: Physics 362 or 462 and 481, or consent of instructor. 1 unit.
- 465. Plasma Physics.** Survey of plasma phenomena in nature and in the laboratory; physical description of plasma phenomena by the independent particle model, one- and two-fluid models, magnetohydrodynamic equations, and kinetic equations; and applications to quantum plasmas, nonlinear effects and turbulence in plasmas, and astrophysical and thermonuclear plasmas. Prerequisite: Physics 342 or equivalent, or consent of instructor. 1 unit.
- 470. Introduction to Nuclear and Particle Physics.** Basic facts of photons, leptons, hadrons, conservation laws, types of interaction, particle production and stability symmetries, and nuclear forces and ground state properties; two-particle systems: electromagnetic interactions, bound states, and resonances; nucleon-nucleon and meson-nucleon interactions; nuclei: properties of low-lying states, models, resonant reactions, and direct processes; and particles and weak interactions: multipion resonances, symmetry schemes, beta decay and other leptonic processes, and strange particle decays. Prerequisite: Physics 480 or consent of instructor. 1 unit.
- 471. Nuclear Physics, I.** Systematics of stable nuclei and the nuclear potential; properties of odd-A nuclei; spherical single-particle shell model; residual interactions; collective states and deformed nuclei; summary of theory and experiment for low-lying states; momentum distribution of nucleons; and fission. Prerequisite: Physics 470. 1 unit.
- 475. Particle Physics, I.** Particles: properties and systematics; S-matrix theory; application of symmetry and invariance principles to decays, production processes, and polarization; collision processes; mesonic and baryonic resonances; symmetry schemes; particle scattering at very high energies; and theory of pion-nucleon scattering, dispersion relations, and Mandelstam representation. Prerequisite: Physics 470; credit or concurrent registration in Physics 483 recommended. 1 unit.
- 476. Particle Physics, II.** Electromagnetic interactions of particles, form factor, and predictions of unitary symmetry; beta and muon decay and capture, conserved and partially conserved currents, neutrino interactions, and weak interaction form factors; leptonic and nonleptonic decays of strange particles; neutral K-meson decays; and current topics. Prerequisite: Physics 470; credit or concurrent registration in Physics 483 recommended. 1 unit.
- 480. Quantum Mechanics, I.** A second course in quantum mechanics for students with a good background in wave mechanics and atomic and molecular structure. Operators, state vectors, and the formal structure of quantum theory, and operator treatments of simple systems; angular momentum and vector addition coefficients; stationary state perturbation theory; introduction to scattering theory for particles without spin, partial wave analysis, and Born approximation; and examples taken from atomic, nuclear, and elementary particle physics. Prerequisite: Senior-level atomic physics and quantum mechanics, or consent of instructor. 1 unit.

481. **Quantum Mechanics, II.** Spin and identical particles, simple many-particle systems and elements of second-quantization theory; time-dependent processes, radiative transitions, and quantization of the electromagnetic field; scattering of particles with spin; polarization; and introduction to the Klein-Gordon and Dirac equations, and properties of simple relativistic systems. Prerequisite: Physics 480 or consent of instructor. 1 unit.
483. **General Field Theory.** Covers standard techniques of field theory as used by experimenters and theorists; relativistic quantum mechanics of a single particle; Lagrangian field theories, perturbation theory, and calculation of lowest-order processes; introduction to Feynman diagrams and higher order processes; and examples taken from quantum electrodynamics, solid-state and elementary particle physics, and many-body theory. Prerequisite: Physics 481 or consent of instructor. 1 unit.
485. **Advanced Field Theory.** Quantization procedures, renormalization theory, dispersion relations, and S-matrix theory; recent developments. Prerequisite: Physics 483 or consent of instructor. 1 unit.
489. **Solid State Physics, I.** Crystalline perfection, free electron gas, screening, plasma oscillations, and dielectric response; Bloch electrons, Brillouin zones, and band structure; semiconductors, intrinsic and extrinsic, with applications; phonons, elasticity, and anharmonicity; ferromagnetism and second-order phase transitions; and superconductivity. Prerequisite: Physics 362 or consent of instructor; and Physics 480. 1 unit.
490. **Solid State Physics, II.** Hartree-Fock theory and electron-electron interactions; electron-phonon interactions; electron dynamics and transport; BCS theory of superconductivity; elastic properties; thermal properties due to anharmonicity; and defects in solids. Prerequisite: Physics 481 and 489. 1 unit.
496. **Seminar on Current Research.** Discussions and lectures on current research, including presentations by graduate students of their own work. 0 units.
497. **Individual Study.** Individual study in a subject not covered in course offerings may be arranged for credit by registration under this number. $\frac{1}{2}$ or 1 unit.
498. **Seminar on Special Topics in Modern Physics.** Lecture course in topics of current interest. Several subjects are announced in each *Timetable*. Among them are semiconductor physics, magnetic resonance, surface physics, lattice dynamics, band theory of solids, crystal imperfections, nuclear structure, field theory, elementary particle physics, advanced statistical mechanics, plasma theory, astrophysics, atmospheric physics, group theory, and applications. Prerequisite: Determined for each offering. $\frac{1}{2}$ or 1 unit.
499. **Thesis Research.** 0 to 4 units.

PHYSIOLOGY

(See Life Sciences)

PLANT PATHOLOGY

Head of Department: Professor R. E. Ford

Department Office: 218 Mumford Hall, Urbana

204. **Introductory Plant Pathology.** Basic concepts relating to causal agents of representative diseases, symptoms and diagnosis, modes of infection and spread, effects of environment on disease development, and methods of control; lecture and laboratory. Prerequisite: Botany 100 or equivalent. 3 hours.

300. **Special Problems.** For students desiring to study specific problems not assigned in other courses. Prerequisite: For undergraduates only, a minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean in advance of registration is required for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit.
302. **Research Methods in Plant Pathology.** Techniques for the isolation, identification, culture of, and inoculation with plant pathogens; methods for the histological study of diseased plants; and recording of data. Prerequisite: Plant Pathology 204 or equivalent; senior standing. 3 hours or $\frac{3}{4}$ unit.
303. **Plant Nematology.** Experimental techniques, nematode anatomy, taxonomy, biology, and host-parasite relations; intensive study of selected groups including foliar, stem, root-knot, and cyst nematodes; interaction with bacteria, fungi, and viruses in plant disease development; and control principles. Prerequisite: Plant Pathology 204 or equivalent; an introductory course in zoology or biology. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
304. **Forest Pathology.** Same as Forestry 304. Principles of forest and shade-tree diseases; symptoms, causal agents, and control of major tree diseases and wood decays; and the role of man in creating and solving disease problems. Prerequisite: Botany 100 or equivalent. 3 hours or $\frac{3}{4}$ unit.
305. **Plant Disease Development and Control.** Fundamental concepts of plant disease development and control, including a consideration of the interactions of host, biotic, and abiotic causal agents, and environment; discussion of the application of nonchemical and chemical methods to disease control. Prerequisite: Plant Pathology 204, a course in organic chemistry, or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
307. **International Food Crops.** Same as Horticulture 307. Various international food crops studied with emphasis on production and problems created by diseases and insects; tropical and subtropical crops stressed, but temperate food crops of international importance included; and ecological factors affecting fundamentals of food crop production and plant protection emphasized. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
308. **Plant Disease Diagnosis.** Field and laboratory techniques in plant disease diagnosis and appraisal; identification of diseases of small grains, turf, corn, soybeans, forage crops, vegetables, fruit, forest and shade trees, and ornamentals, both on field trips and in laboratory exercises. Prerequisite: Plant Pathology 204 or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered during summer session only.
377. **Diseases of Field Crops.** Same as Agronomy 377. Study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in alternate years.
401. **Diseases of Forest and Shade Trees.** A survey of the history, symptomatology, causes, and control of diseases of trees, with assigned reading and performance of illustrative experiments in the laboratory, greenhouse, and field. Prerequisite: Plant Pathology 204 or consent of instructor. $\frac{1}{2}$ or 1 unit. Offered in alternate years.
402. **Phytopathology.** Study of pathogenic bacteria and their role in plant disease; history, morphology, reproduction, taxonomy, and identification; emphasis on arrival, invasion, symptoms, and control; and assigned reading, lectures, and laboratory. Prerequisite: Plant Pathology 204 and Microbiology 309, or consent of instructor. $\frac{3}{4}$ unit. Offered in alternate years.
403. **Physiology of Fungi.** Same as Botany 403. The germination, growth, metabolism, and sporulation of fungi; physiology of the fungi as related to parasitism, antibiotic production, vitamin assay, and industrially important products; and discussion of the nature

- of fungicidal activity. Prerequisite: Plant Pathology 204 or equivalent; organic chemistry or biochemistry; mycology and microbiology. 1 unit. Offered in alternate years.
- 404. Plant Virology.** Fundamental concepts; classification, symptomatology, and infectivity; biological, chemical, and physical properties; techniques for transmission, straining, assay, filtration, and purification; control methods; sources of information; and history of virology. Prerequisite: Consent of instructor. $\frac{1}{2}$ or 1 unit. Offered in alternate years.
- 406. Genetics of Plant-Pathogen Interactions.** The genetics and expression of resistance in plants to fungi, bacteria, viruses, nematodes, and other pathogens; variation and genetic systems in pathogens with particular emphasis on pathogenicity; complementary genetic systems; and theory and practice of breeding disease-resistant plants. Lectures, discussions, assigned reading, and term paper. Prerequisite: Plant Pathology 204, Agronomy 323 or Horticulture 323, or consent of instructor. 1 unit. Offered in alternate years.
- 407. Physiology of Plant-Parasite Interactions.** Current concepts on physiological and biochemical bases of plant diseases; mechanisms of infection and disease development; theories of resistance and susceptibility; and interrelationships of physiological and biochemical activities that occur during the interaction of plants and their parasites. Prerequisite: One course each in plant pathology, biochemistry, and plant physiology, or consent of instructor. $\frac{1}{2}$ unit. Offered in alternate years.
- 417. Discussions in Plant Pathology.** Discussion of current research, literature, and other topics pertaining to plant pathology and related fields. $\frac{1}{4}$ unit.
- 431. Plant Cell Metabolism.** Same as Agronomy, Biology, Forestry, and Horticulture 431. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the biochemistry of mature seeds and metabolic processes occurring during seed germination and heterotrophic growth. Meets during the first half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 432. Plant Cell Energetics.** Same as Agronomy, Biology, Forestry, and Horticulture 432. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the energy coupling processes in plant cells (respiration, photosynthesis, photorespiration); and discusses current literature relating to mechanisms of electron transport, phosphorylation, and carbon fixation. Meets during the second half of the fall semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 433. Environmental Regulation of Plant Growth.** Same as Agronomy, Biology, Forestry, and Horticulture 433. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns mechanisms of plant response to the environment, including ion uptake and transport, water relationships, gas exchange, and photosynthesis of whole plants. Meets during the first half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 434. Regulation of Plant Development and Reproduction.** Same as Agronomy, Biology, Forestry, and Horticulture 434. One of four courses giving a comprehensive summary of present knowledge in plant physiology; concerns the hormonal regulation of growth, development, and reproduction and the metabolism of seed and fruit formation. Meets during the second half of the spring semester. Prerequisite: Botany 330 or equivalent, and an introductory course in biochemistry. $\frac{1}{2}$ unit.
- 499. Thesis Research.** Individual study and research required of all students working toward the Master of Science or Doctor of Philosophy in plant pathology. Prerequisite: Plant Pathology 302 or equivalent. Work can be taken in the following areas, subject to approval of the staff member concerned: (a) biochemistry of plant disease; (b) diseases of corn, genetics of resistance; (c) diseases of cereal grains; (d) diseases of forest and shade trees; (e) diseases of fruit crops, fungicides; (f) diseases of leguminous crops, root diseases; (g) diseases of turf and lawn grasses; (h) diseases of soybeans; (i) diseases of vegetable and canning crops; (j) nematode diseases; (k) physiology of fungi, antibiotics; and (l) plant virology. 0 to 4 units.

POLISH

(See Slavic Languages and Literatures under Humanities, School of)

POLITICAL SCIENCE

Head of Department: Professor E. A. Kolodziej

Department Office: 361 Lincoln Hall, Urbana

100. **Introduction to Political Science.** Survey of major concepts and approaches employed in political science. 3 hours.
150. **American Government: Organization and Powers.** Historical development and organization of national, state, and local governments; the federal system; national and state constitutions; civil and political rights; party system; and nature, structure, powers, and procedure of legislative, executive, and judicial departments in state and nation. 3 hours.
151. **American Government: Functions.** Functions of national, state, and local governments; foreign relations and national defense; taxation and finance; law enforcement; police power; regulation of commerce, communications, and business; promotion of social and economic welfare; and current problems. Prerequisite: Political Science 150 or consent of department. 3 hours.
198. **Freshman Seminar.** Current topics in political science in the context of the scope and method of political science. Participants are required to do independent library research and present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
222. **Introduction to Modern Africa.** Same as African Studies, Anthropology, and Sociology 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in the politics, economics, sociology, anthropology, and history of Africa. 3 hours.
240. **Introduction to Comparative Politics.** Basic concepts and principles of political analysis from a comparative perspective. Prerequisite: Political Science 100 or 150, or consent of instructor. 3 hours.
241. **The Emerging Nations.** An introductory comparative consideration of the patterns of political development and of the policies and problems of the emerging nations of Asia, Africa, and Latin America; emphasis on the special characteristics of countries beginning their independent nationhood and the effects of these characteristics on the political systems of these lands and their role in the community of nations. Prerequisite: Three hours of political science or consent of instructor. 3 hours.
245. **Black Political Thought and Movements: U.S.A., Africa, and Caribbean.** Political thinkers and movements discussed include W. E. B. DuBois, Panthers, Garveyism, Black Muslims, Nyerere, Harlem Renaissance, Nkrumah Negritude, and Caribbean Nationalism; use of relevant literature to gain knowledge of black political thought and movements, and use of model construct for the purpose of analysis. Prerequisite: Political Science 150 or consent of instructor. 3 hours.
260. **Introduction to Political Theory.** The nature, structure, and purposes of political theory; uses major works on the problems of political order, obedience, justice, liberty, and representation to distinguish and clarify different theoretical approaches; designed to be an introduction to ideas, not a historical survey. Prerequisite: Political Science 100 or 150, or consent of instructor. 3 hours.
270. **Introduction to Political Research.** Principles of empirical research in political science; emphasizes definition of research problems, principles and practices of measurement, use of data as evidence, and data analysis; data-based analysis is conducted in the So-

- cial Science Quantitative Laboratory. Prerequisite: Political Science 100 or 150, or consent of instructor. 3 hours.
280. **Introduction to International Relations.** The structure and processes of international relations, trends in international politics, and the future of the international system in a setting of conflict and crisis. Prerequisite: Political Science 100 or 150, or consent of instructor. 3 hours.
290. **Individual Study.** Readings and reports in selected fields chosen in consultation with the instructor. Prerequisite: Written consent of instructor. 1 to 4 hours. May be repeated.
293. **Honors Senior Thesis.** Prerequisite: Written consent of instructor; open only to seniors whose field of concentration is political science and who have a general University average of at least 4.0. 2 to 5 hours. May be repeated.
295. **Special Topics in Contemporary Issues and Problems.** Study of a contemporary problem in public policy, domestic or international. See *Timetable* for current topics. Prerequisite: Sophomore standing, 3 hours of political science, or consent of instructor. 3 hours. May be repeated for credit.
296. **Special Topics in Political Science.** Selected reading and research in political science. Prerequisite: Junior or senior standing; 6 hours of political science; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 297.
297. **Honors Seminar.** Research, reading, and discussion in selected topics and works in literature of political science. Prerequisite: Junior or senior standing; 6 hours of political science; 4.0 average or James Scholar designation; consent of instructor. 3 hours. No more than 6 hours of credit may be earned by registration in this course and in Political Science 296.
305. **Municipal Government.** Growth of cities; their legal status; and municipal politics and organization in the United States. 3 hours, or $\frac{1}{2}$ or 1 unit.
306. **Municipal Problems.** Municipal administration in the United States; administrative organization; personnel problems; financial problems; city planning and housing; police and fire administration; public health; and public utilities. Prerequisite: Senior standing, or junior standing with Political Science 305 or Economics 101, or 6 hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
310. **Rural Local Government.** Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; and problems of reorganization. 3 hours, or $\frac{1}{2}$ or 1 unit.
312. **State Government.** The states in the federal system; state constitutions and problems of revision; organization, powers, and functions of the legislative, administrative, and judicial branches of state government; state functions; reorganization problems in the states; state-local relations; and state finance, trends, and prospects. Students are not given credit for both Political Science 312 and 110. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
313. **Comparative State Politics.** Approaches state government from an empirical and behavioral orientation, using contemporary sources chosen to introduce current analytical techniques and methods for explicating state politics; analysis of interactions among branches of government along with the impact of policy, interest groups, and constituencies. Prerequisite: Political Science 312, 315, or 328, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
314. **The Presidency.** Determinants and growth of presidential influence; presidential decision making; the president's role in the formulation and implementation of public policy; the president and constituencies; and the president's roles as legislator, party leader, and chief executive. Prerequisite: Political Science 100 or 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
315. **Legislatures and Legislation.** The legislative function in government; structure and organization of American legislatures (national, state, and local); party organization in legislatures; legislative procedure; pressure groups and lobbying; relation of legislature

- to other branches of government; and problems of legislative reorganization. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **The American Federal System.** The nature, justification, and problems of federalism; coordination of governmental efforts by contract, subsidies, and grants; and comparison of federal systems. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Government and the Economic Order.** Interplay of political and economic phenomena at various domestic, foreign, and international levels and applicability of certain generalized models. Prerequisite: Any two courses in political science or a combination of political science and economics. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Approaches to Political Populations.** Studying political populations through participant observation, nonreactive measures, content analysis, field research, interviewing, questionnaire design, (and other techniques); research ethics surrounding the use of tape recorders, cameras, etc. Prerequisite: Twelve hours of social science; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
326. **American Political Parties.** Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention systems; the primary; and campaign methods and finance. Prerequisite: Political Science 150 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
327. **Black Political Participation in the American Political Process.** Exposes students to the variety of literature on black people in American politics; political participation is the major theme. Since black and white scholars address themselves to the study of political behavior of blacks, it is necessary to compare not only their views but also to discuss the underlined message, or meaning, of their work to understanding American politics in general. Prerequisite: Political Science 150, or 6 hours or social science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
328. **An Introduction to the Study of Political Behavior.** An analysis of the interrelations of political attitudes and public formation; special attention to the substantive areas of voting behavior, political leadership, and the rise of political mass movements; and also a review of the literature on democratic and authoritarian personality types. Prerequisite: Political Science 150 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
329. **Electoral Behavior.** Study of the social and psychological motivations behind the individual voting decision, with special emphasis on the relationships between the voting decision and social stability. Prerequisite: Six hours of political science. 3 hours, or $\frac{1}{2}$ or 1 unit.
331. **British Government.** Nature of the British Constitution; the Crown, Ministry, and Cabinet; Parliament and elections; the party system; law and the courts; local government; and the British Commonwealth. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
335. **Government and Politics of the Soviet Union.** Evolution, structure, and functioning of the Soviet system of government; the theories, structure, and functioning of the Communist party of the Soviet Union. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
336. **Governments and Politics in Western Continental Europe.** An analysis of the major governmental systems of continental Europe; the evolution, structure, and functioning of the political institutions of France, Germany, Italy, Spain, Switzerland, and the Scandinavian countries as illustrations of multiparty and dictatorial types of governments. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
337. **Government and Politics of China.** An introduction to the governments and politics of modern China. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Governments and Politics in the Middle East.** An analysis of the transformation of Middle Eastern society from Morocco to Iran, as case studies in political modernization; study of politics of the area with special reference to causes and character of modernization, role of leadership, ideologies and institutions, methods and theories for ana-

- lyzing political systems undergoing fundamental transformation, and implications for U.S. policy. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
339. **Governments and Politics of Sub-Saharan Africa.** Analysis of major political systems in Africa south of the Sahara; emphasis on the development of states and the modification of social and political systems; and a general survey of the area supplemented by a focus on selected countries. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
340. **The German Political System.** Structures and processes of postwar German politics, with primary emphasis on West Germany; special attention to foreign policy formulation and problems (particularly defense), the Berlin issue, reunification, and relations with Eastern Europe. Knowledge of German helpful but not necessary. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
342. **Government and Politics in Latin America.** A survey of the origin and development of Latin American political institutions; systems of government; public administrative systems; party government; and international policies of Latin American governments. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
343. **Political Systems and Structures of Latin American Countries.** The political process, generally of selected Latin American countries at different levels of political development; stress on the interaction between political infrastructure and more formal agencies of government; and may include cross-national comparison of the function of such factors as political culture, party system, bureaucracy, or the military establishment. Prerequisite: Political Science 342. 3 hours, or $\frac{1}{2}$ or 1 unit.
345. **Comparative Communist Systems: Asia.** Examination of the origins and development of modern communism in East Asia. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
346. **Comparative Communist Systems: Eastern Europe.** Analysis of the origins of modern communism and the development of its doctrines; applications of these doctrines in the practices of ruling Communist parties; emphasis on alternates between European and non-European Communist systems, depending on course instructor. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
347. **Governments and Politics of Southeast Asia.** Comparative analysis of the political development of the countries of Southeast Asia, the lands to the east of India and south of China; emphasis on the differing approaches to the governing of man and the formation of public policy to be found in these countries; and consideration of economic, social, historical, and geographical influences on political development. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
348. **Government and Politics of Japan.** Introduction to the government and politics of modern Japan. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
349. **Governments and Politics of South Asia.** A comparative analysis of the political development of India, Pakistan, Ceylon, and the lesser lands of South Asia; emphasis on the differing approaches to the governing of man and the formation of public policy to be found in these countries; and consideration of economic, social, historical, and geographical influences on political development. Prerequisite: Political Science 240 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
350. **Law and Society.** An introductory study from a social science perspective of the nature of law, law makers, and law appliers; the causes or inputs determining law; and the effects or outputs which law in general produces. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
351. **American Constitutional System.** Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate commerce; and jurisdiction of courts. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.

352. **Comparative Constitutional Law.** A comparative analysis of the constitutional law cases from a variety of countries with particular emphasis on how the cases have resolved issues relating to civil liberties and the allocation of power among governmental bodies. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
353. **Law and Politics of Poverty.** Study of court cases and other materials dealing with the legal rights and obligations of the poor as tenants, consumers, welfare recipients, employees, arrested persons, family members, legal clients, and political participants; emphasis on the constitutional, political, and sociological aspects of the legal rights involved including the political process through which relevant judicial and legislative policy is made and applied. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **The Judicial Process.** A systematic analysis of legal, evidentiary, environmental, and personal factors that influence judicial decision making, with particular emphasis on the application of the scientific method to the study of judicial behavior. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **The Constitution and Civil Liberties.** Study of free speech, loyalty in a democratic state, citizenship, freedom of religion, rights of persons accused of crime, and government's responsibility to protect persons from racial and religious discrimination; and special attention to the role of law and judges. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **Public Administration and the Judicial Process.** The scope of administrative powers and their relation to private rights; a comparison of the processes of decision in administrative agencies and in the courts; the interests served by each; the impact of judicial review of administrative decisions upon administrative procedure and policy; the constitutional and statutory bases of review; and the legal accountability of public officers versus political accountability. Prerequisite: Political Science 305, 351, or 361, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
357. **Law and Politics of Environmental Protection.** Study of court cases, legislation, and social science materials dealing with air, water, noise, and waste pollution and conservation; particular emphasis on the political factors involved. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **Jurisprudence.** Nature and sources of law; law and the state; law and justice; and evolution, arrangement, and subject matter of law. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **Introduction to Public Administration.** Development of administrative organization; administration and the executive, legislature, and judiciary; principles of organization, including line and staff relationships; the staff services of finance and personnel; and formal and informal control. Prerequisite: Political Science 150. 3 hours, or $\frac{1}{2}$ or 1 unit.
362. **Administrative Organization and Policy Development.** Dynamics of policy formulation in public administrative agencies; current developments in organizational theory and their significance for public administration; origin of public administrative organizations; interpersonal behavior; large-scale organizations and centralization; external support and opposition; and policy formation and problems of compliance. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
363. **Comparative Administration.** Study of modern bureaucratic organization by means of the comparative method; special reference to the bureaucracies of various countries in different stages of industrialization; and the cultural bases of administrative behavior. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
366. **Tools of Public Management.** A critical survey of the tools of analysis available to overhead functions of public management in key areas of decision; emphasis on personnel administration and manpower utilization; budgetary processes and fiscal controls; and several methods of administrative analysis: organizational studies, procedures engineering, information processing, and operations research. Prerequisite: Political Science 361 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
371. **World International Organization.** General development and basic principles of world organization; principles, structure, methods, and actual operation of international gov-

- ernmental institutions; and special attention to the United Nations and related agencies and to their evolution from the League of Nations system. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
377. **International Communications.** Same as Communications 377. An interdisciplinary approach to international communications; its structure and content; the role of international communications in conflict and conflict resolution; the semantics of international communication; the technical and economic aspects of international mass communications; and government-industry relations in communications. Prerequisite: Political Science 280 or consent of instructor. 3 hours or 1 unit.
380. **Comparative Foreign Policies.** An analysis of the formulation and substance of the foreign policies of select nations of the world. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
381. **American Foreign Relations.** Participation in international affairs; presidential initiative; development and organization of the Department of State; diplomatic intercourse; consular service; treaty-making power; and development of foreign policy. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
382. **Contemporary American Foreign Policies.** Study of the major foreign policy decisions currently confronting the United States government: analysis of background, principal issues, and alternative actions; formulation of policies. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Soviet Foreign Policy.** Survey of Soviet foreign policy from 1917 to the present, with emphasis upon the forces shaping this policy; special attention to the interplay of ideology and national interest in policy formulation. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
384. **International Relations.** Examination of contemporary international systems in terms of the types of actors and their goals, various structures of power, and the mechanisms of allocating resources and containing conflict. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
385. **International Law.** Nature, source, and development of international law and certain basic rights and obligations of the subjects thereof. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
386. **International Law.** Responsibility, intercourse, and redress of differences between states. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
387. **National Security Policy.** Examination of the organization and formulation of current American defense policy; the theory and practice of deterrence, with special reference to American and Soviet military strategy; and the problems of disarmament and arms control. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
388. **The Military and Politics.** The role of the military in national and international policies, with special attention given to theories of war and peace, civil-military relations, the military and the political development of Western and non-Western states, and the nonmilitary uses of the military. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
389. **Chinese Foreign Policy.** An analysis of the formulation, substance, and conduct of Chinese foreign policy, with emphasis on the period since 1949; special attention to the forces shaping Chinese policy. Prerequisite: Political Science 280 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
390. **Methods of Political Analysis.** Presentation of the analytic processes in the development of concepts, hypothesis, and theories; discussion of the derivation, formulation, and specification of research problems to be related to basic methodologies and modes of analysis; and applications to political science. Prerequisite: Political Science 270, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
392. **Socialist Political Theory.** Origins, development, and recent modifications of socialist theory from the late eighteenth century to the present; examination of each contribu-

- tion in terms of its goals, efficacy, and subsequent influence; and discussion including Rousseau, Hegel, the Utopians, Marx and Engels, Anarcho-syndicalists, Lenin, Luxemburg, Trotsky, Mao, Guevara, and Garaudy. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
393. **Classical Political Theory.** A consideration of major works of Greek and Roman political theory, and especially of their relevance to modern political analysis and action. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
394. **Medieval Political Theory.** The development of political theory from the Church Fathers to the sixteenth century: Augustine, Thomas Aquinas, Dante Alighieri, Marsiglio of Padua, Machiavelli, Thomas More, and others; conflicts of church and state, theories of natural law, natural rights, kingship, legitimacy, popular sovereignty, and representative government. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
395. **Modern Political Theory.** A critical analysis of political theories from the sixteenth century to the present; focus on the development of such concepts as the nature of man, the role of the state, justice, legitimacy, obligation, individual rights, equality, and mechanisms of maintenance and change. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
396. **Contemporary Political Theory.** Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; and antidemocratic thought and totalitarian regimes. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
397. **American Political Theory.** Survey of American political thought from colonial times to the present. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
398. **Theory and Practice of Democratic Government.** Theories of the nature and conditions of democracy; comparison and analysis of contemporary democratic institutions. Prerequisite: Political Science 260 or consent of instructor. 3 hours, or ½ or 1 unit.
400. **Selected Topics in Political Theory.** Reading, analysis, and discussion of selected topics of political theory. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
401. **History of Political Theories.** Reading and analysis of the leading political thinkers from the Greeks to the middle of the seventeenth century. 1 unit.
402. **History of Political Theories.** Readings and analysis of the leading political thinkers from the middle of the seventeenth century to the present. 1 unit.
406. **Municipal Administration.** Position of cities in American governmental systems; governmental interrelationships; powers; services; and current municipal problems. 1 unit.
412. **Problems in State Government.** Research in selected topics in American state government. 1 unit.
420. **Formation of Public Policy.** Same as Labor and Industrial Relations 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legislative procedures, and judicial activity. 1 unit.
423. **Proseminar in American Politics.** An intensive analysis of major institutions and processes of American politics (national, state, and local); research on selected topics in American government. 1 unit.
425. **Personality and Political Process.** Rationality and its limits in political processes; the functions of symbols and myth in politics; political involvement and quiescence; and nonrational elements in legislation and administration. Prerequisite: Consent of instructor. 1 unit.
426. **Political Parties.** Special problems in political parties; methods and materials of research in this field. 1 unit.
427. **Psychological Bases of Political Behavior.** Introduction to the relationships of psychological mechanisms and life history factors to individual or group political behavior;

- topics include national loyalty and ideology, mass publics and political involvement, political authority, and individual compliance. 1 unit.
428. **Multivariate Analysis for Political Scientists.** Applied use of extended analysis of variance; multiple classification analysis, factor and small-space analysis, causal analysis, multiple regression, and selected topics for research. Prerequisite: Sociology 387 and Political Science 497, or consent of instructor. 1 unit.
430. **Proseminar in Comparative Politics.** Comparative political analysis in the context of the evolution of the social sciences and modern political science, with emphasis on theories of political action and their function in contemporary comparative studies. This course is designed as an introduction to area-oriented seminars and generally is a prerequisite for them. 1 unit.
435. **Problems in the Government of Soviet Russia.** Special topics relating to the government of the Soviet Union. 1 unit.
437. **Problems in Chinese Politics and Government.** Research in selected topics relating to the political system of China. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
439. **Problems of African Politics and Government.** Analysis of political problems of African states. 1 unit. May be repeated to a maximum of 2 units.
440. **Comparative Politics and the Political Process.** The comparative study of selected national political systems or of specific institutional forces that influence the making and application of public policy in several countries. The countries studied and the legal and extralegal political agencies considered vary according to the person conducting the seminar. 1 unit. May be repeated to a maximum of 3 units.
441. **Politics in the Developing States.** Examination of the political processes in the developing countries; examination of the general problems arising in the transition from traditional societies to modern industrial states in order to describe the typical patterns of political change; and special attention given to contemporary literature and studies. Prerequisite: Political Science 430; consent of instructor. 1 unit.
442. **Problems of Latin American Politics and Government.** Special topics relating to Latin American politics and government; individual countries may be studied or comparative analysis of particular political and governmental functions or problems may be undertaken. Prerequisite: Political Science 430 and 441, or equivalent. 1 unit. May be repeated to a maximum of 2 units.
446. **Problems of Southeast Asian Politics and Government.** Research in the political systems of Southeast Asia. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
448. **Problems in Japanese Politics and Government.** Study of scholarly literature on modern Japanese politics and examination of selected problems in modern Japanese politics. Prerequisite: Credit or concurrent registration in Political Science 430, or consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
450. **Contemporary Governmental Problems.** Special problems of current importance designed especially for students not majoring in political science. 1 unit. May be repeated to a maximum of 3 units.
451. **Constitutional Law.** Research in selected topics in the American constitutional system. Prerequisite: Political Science 351 or equivalent. 1 unit.
453. **Law, Policy, and Social Science.** The application of social science research techniques to improving legal procedure and legal substance; emphasis on constitutional law and other public law subjects, but also consideration of other fields of law. 1 unit.
460. **Organizational Sciences, I.** Same as Business Administration 410, Psychology 453, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; in addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Pre-

requisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.

465. **Problems in Administrative Management.** Analysis of methods of applying administrative principles and procedures to operating problems in government agencies, such as methods of administrative coordination and control, intergovernmental cooperation, legislative-administrative relations, the organization of regulatory functions, and review of administrative decisions. Prerequisite: Political Science 361 or consent of instructor. 1 unit.
466. **Current Administrative Theory.** A discussion of some recent trends in administrative opinion and practice on such questions as agency structure and functional activities; field and regional organization and relations; the role and functions of the executive; the process of decision making; the relations of line and staff activities; the communication and execution of policies and programs; and employee relations. 1 unit.
469. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations, Social Work, and Administration, Higher, and Continuing Education 497. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state, and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
471. **Problems in International Organization.** Methods and materials of research in international organization; special topics, such as disarmament, security, procedural problems in the United Nations, economic and social problems, and amendment and revision of the Charter. 1 unit.
480. **Scope and Theory in International Relations.** Deals with the field of international relations, its relationship to political science and the other social sciences; treats the development of the field by examining major theories and approaches that have characterized it in the past, but with emphasis on contemporary theories and concepts. 1 unit.
481. **Methodology in International Relations.** Deals with major research methodologies in contemporary international relations; includes case studies, aggregate data, content analysis, survey research, gaming and simulations, and causal modelling; and presumes knowledge of basic international relations theory. Prerequisite: Political Science 480. 1 unit.
482. **Foreign Relations of the United States.** Special problems in the development and conduct of American foreign policy. 1 unit.
483. **United States Foreign Policies.** Study of selected current problems in foreign policy; use of power; problems of negotiation; relations with new states; and foreign aid. 1 unit.
484. **International Relations: Special Problems in Theory and Research.** Advanced seminar on special topics in international relations. Prerequisite: Political Science 480 or 481, or consent of instructor. 1 unit. May be repeated under different instructors for a maximum of 3 units.
490. **Proseminar in Political Behavior, I.** Interdisciplinary approaches to the analysis of political behavior; formation of opinions, interests, roles, and personality; applications of organization theory to political institutions; applications of conflict and bargaining theory to political processes; and systematic studies of the distribution of values. 1 unit.
491. **Proseminar in Political Behavior, II.** Continuation of Political Science 490. Prerequisite: Political Science 490. 1 unit.
492. **Problems of Explanation in Social Science.** Special topics in the methodology of social sciences, especially theory formation and theory testing. 1 unit.
493. **Research in Selected Topics.** Research in selected topics by arrangement with the instructor. ½ to 3 units.
495. **Scope and Methods of Political Science.** Definitions of the scope and subject matter of political science; methodological issues in political science; major conceptions of methodology as embodied in current leading studies of politics; and the present state of research in political science. 1 unit.

496. **Political Concepts: Formulation and Measurement.** Indicates the relevance of certain research techniques for answering questions of concern in political science; indicates the range of tools available to the student; and includes discussion of problems in concept formation. Current methods of concept measurement are presented to the student in the context of political research problems. Prerequisite: Consent of instructor. 1 unit.
497. **Research Design and Techniques.** Introduction to problems of research design, data collection, data analysis and interpretation, sampling, and some simple measures of statistical association and significance. Prerequisite: Political Science 496. 1 unit.
498. **The Logic of Political Inquiry: Selected Topics.** Application of analytic principles and procedures developed in Political Science 495 to such topics as patterns of explanation; current theoretical perspectives; group theory, functionalism, systems theory, decision making, simulation, etc; the logic of judicial decisions; and justifications of political ideologies. This list is not exhaustive, nor will all of these topics be included each semester. Prerequisite: Political Science 495. 1 unit. May be repeated to a maximum of 2 units.
499. **Thesis Research.** 0 to 4 units.

PORTUGUESE

(See Spanish, Italian, and Portuguese under Humanities, School of)

PSYCHOLOGY

Head of Department: Professor J. E. McGrath

Department Office: 315 Psychology Building, Champaign

100. **Introduction to Psychology.** Study of human behavior with special reference to perception, learning, memory, thinking, emotional life, and individual differences in intelligence, aptitude, and personality; emphasis on the scientific nature of psychological investigations; and discussion of research methods and the relation of their results to daily life and everyday problems. Lectures, discussions, and five hours of participation in laboratory experiments. Not open to students electing Psychology 103 or 105. 3 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
101. **Theory and Practice of Psychological Research.** Consideration of research methods and problems of research design in psychology; participation in ongoing research of the staff of the department. Prerequisite: To be taken concurrently with Psychology 100, 103, or 105, or with the consent of the academic adviser of the Department of Psychology. 1 hour. May not be repeated.
103. **Introduction to Experimental Psychology.** An in-depth survey of basic topics in experimental psychology; emphasis on conditioning, learning, perception, and animal behavior with stress placed on the biological aspects of these problems. Lecture and laboratory. Not open to students electing Psychology 100 or 105. 4 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
105. **Elements of Psychology.** Description and explanation of the psychological principles of everyday living, with emphasis on how behavior is motivated, how individuals learn intelligent behavior, personality, and applications of psychology to various social issues. Lectures, discussions, and five hours of participation in psychological experiments. This course may be substituted for Psychology 100 when the latter is listed as a prerequisite or a recommended elective. For placement purposes, enrollment is limited to students whose ACT composite score is 21 and below. Not open to students electing Psychology

- 100 or 103. 4 hours. Psychology 101 may be taken concurrently for 1 hour additional credit.
115. **Design and Interpretation of Psychological Research.** Introduction to methodology for laboratory and field research; basic descriptive and inferential statistics emphasizing interpretation of statistical results rather than computation; and discussion of illustrative research from several areas of psychology. Prerequisite: Psychology 100, 103, or 105; or consent of departmental academic advisor. 3 hours.
143. **Biological Bases of Human Behavior.** Same as Anthropology, Home Economics, and Zoology 143. A critical consideration of data and information bearing on current controversies and ideas concerning the antecedents of selected aspects of human behavior; topics include communication and social organization, and parental, sexual, and aggressive behavior. 3 hours.
198. **Freshman Seminar in Psychology.** Lecture-discussions devoted to the in-depth study of a topic of current interest in psychology. The specific topic studied is elected by the students from those topics falling within the area of competence of the instructor. The instructor rotates from one semester to another so that the general area changes as the instructor changes. Prerequisite: Open only to James Scholars. There may be additional prerequisites from time to time as the topic of the seminar changes. For example, there may be a mathematics prerequisite for a seminar in mathematical psychology or a biological science prerequisite for a seminar in physiological psychology. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Introduction to Social Psychology.** Systematic study of social factors in individual and group behavior; attention to social perception, motivation, and learning; attitudes, norms, and social influence processes; the development and dynamics of groups; and the effects of social and cultural factors on the individual. Credit is not given for both Psychology 201 and Sociology 201. Prerequisite: Psychology 100, 103, or 105. 3 hours.
211. **Physiological Psychology.** Survey of classical and modern concepts of the physiological basis of behavior; particular emphasis on the sensory systems, regulatory mechanisms, and learning. Prerequisite: Psychology 100, 103, or 105; Physiology 103 or 106. 4 hours.
216. **Child Psychology.** Study of the psychological development of the child. Prerequisite: Psychology 100, 103, or 105. 3 hours.
217. **Comparative Development.** Survey of phylogenetic and ontogenetic development of behavior. The first part of the course considers the comparative psychology of representative phyla, with special emphasis on the development of sensorimotor coordination, motivation, and learning. The second half of the course is concerned with development of behavior in the individual organism, with most attention devoted to behavioral changes during the life span of vertebrate organisms. Prerequisite: Psychology 100, 103, or 105. 3 hours.
230. **Perception and Sensory Processes.** Survey of the experimental psychology of sensory and perceptual processes and behavior; emphasis on the contribution of behavior science to understanding subjective experience of the physical and social environment. Prerequisite: An introductory course in psychology, physiology, or zoology. 3 hours.
233. **Introduction to Quantitative Methods, I.** Descriptive statistics, including measures of central tendency and dispersion, correlation, probability, transformations, and basic distribution theory; basic principles of sampling and research design. Laboratory includes discussion of problems and application of statistical methods to data from experiments and surveys. Prerequisite: Psychology 100, 103, or 105; college algebra or equivalent; or consent of departmental academic adviser. 3 hours. Students may not receive credit for Psychology 233 and Psychology 235, Economics 171 or 172, Mathematics 161, Sociology 185 or 385, or Educational Psychology 390.
234. **Introduction to Quantitative Methods, II.** Inferential statistics, including sampling distributions estimation, hypothesis testing, regression, correlation, and basic analysis of variance procedures. Laboratory includes discussion of problems and application of statistical methods to data from experiments and surveys. Prerequisite: Psychology 233. 2

- or 3 hours. Students who have earned credit in Economics 171 or 173, Mathematics 161, Sociology 185, or Educational Psychology 390 receive 2 hours credit in Psychology 234. Students may not receive credit for both Psychology 234 and 235.
- 235. Quantitative Methods.** Development of skill and understanding in the application of statistical methods to problems in psychological research; topics include descriptive statistics, probability, estimation, basic inferential methods, regression, correlation, and basic analysis of variance procedures. Laboratory includes discussion of problems and application of statistical methods to data from experiments and surveys. Prerequisite: Psychology 100, 103, or 105; college algebra or equivalent; or consent of departmental academic adviser. 2 or 5 hours. Students who have earned credit in Economics 171 or 173, Mathematics 161, Sociology 185 or 385, or Educational Psychology 390 receive 2 hours credit in Psychology 235. Students may not receive credit for Psychology 235 and Psychology 233 or 234.
- 245. Industrial Organizational Psychology.** A systematic study of the application of psychological methods and principles in business and industry; emphasis on personnel selection and factors influencing efficiency. Prerequisite: Psychology 100, 103, or 105; credit or concurrent registration in a statistics course. 3 hours.
- 246. Vertebrate Social Organization.** Same as Anthropology, Sociology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
- 247. An Introduction to Behavior Genetics: Lecture.** Same as Anthropology 247. Examination of relations between genetic mechanisms, population structure, race, and individual differences in behavior; survey of research and future possible behavior-genetic analyses; and applications such as genetic counseling. Prerequisite: Psychology 100, 103, or 105, or Biology 100, or Physiology 103; and a course in statistics which may be taken concurrently. 3 hours.
- 248. Psychology of Learning and Memory.** Survey of basic phenomena in learning and memory emphasizing experimental data from animal and human research. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 250. Psychology of Personality.** The study of personality from various points of view: biological, experimental, social, and humanistic; surveys theory and empirical research in the study of personality. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 258. Human Factors in Man-Machine Systems.** Examination of equipment and training variables that influence the human operator in man-machine systems; includes the nature of man-machine systems, the capabilities of men and machines, and simulation for design decision; and research and principles for the design and use of symbolic and pictorial displays, control systems, and simulators for training. Prerequisite: Psychology 100, 103, or 105. 3 hours.
- 289. Introduction to Quantitative Theories in Psychology.** A survey of major quantitative theories and methodologies in psychology: models of human judgment, decision, and attitude formation, unidimensional and multidimensional scaling of stimulus domains, signal detection theory, probability and computer models of learning and higher mental processes, quantitative theories of mental test scores, and multidimensional models of ability, attitude, and personality structure. Prerequisite: Psychology 235 or equivalent. 4 hours.
- 290. Individual Study.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; written consent of instructor. 1 to 4 hours. May be repeated to a maximum of 9 hours.
- 293. Honors Senior Thesis.** Planning, researching, and writing of an undergraduate honors thesis, under supervision of a faculty member, on a problem of appropriate scope and character. Prerequisite: Psychology 297. 2 to 4 hours.
- 294. Individual Topics.** Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of

the department, students may be admitted with a grade-point average of 3.75. 2 to 4 hours.

297. **Junior Honors Seminar.** Seminar on experimental methods and contemporary psychological research. Prerequisite: Junior standing and admission to departmental honors program. 0 to 4 hours.
298. **Senior Honors Seminar.** Continuation of Psychology 297. Prerequisite: Psychology 297. 0 to 4 hours.
306. **Quantitative Methods, I.** A lecture and laboratory course in the development and application of quantitative methods in psychological research. Prerequisite: Twelve hours of psychology, including Psychology 115 or equivalent. 4 hours or 1 unit.
307. **Quantitative Methods, II.** Continuation of Psychology 306. Prerequisite: Psychology 306. 4 hours or 1 unit.
311. **Laboratory in Physiological Psychology.** Research on classical and current problems; emphasis on the nervous and endocrine systems in information processing and in the regulation of behavioral adaptation; and examples from sensation, perception, motivation, emotion, and learning. Laboratory. Prerequisite: Psychology 211. 4 hours, or $\frac{1}{2}$ or 1 unit.
324. **Psychology of Thinking.** Survey of problems, experimental methods, and research findings in human thinking; emphasis on concept formation, problem solving and decision making, and creativity. Prerequisite: Psychology 235. 3 hours or 1 unit.
325. **Psychology of Language.** Survey of theory and research in the psychology of language; topics include relation of linguistics and psychology, language development, and influence of language on perception, memory, and thought. Credit not given for both Psychology 325 and Linguistics 325. Prerequisite: Six hours of psychology or consent of instructor. 3 hours or 1 unit.
326. **Motivation and Emotion.** The nature and development of emotion, attitude, and motive, and the role of these processes in social adjustment. Prerequisite: Six hours of psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
330. **Experimental Psychology, I.** Survey of problems, experimental methods, and research findings in the fields of psychophysics, sensory processes, perception, judgment, and thinking. Prerequisite: Psychology 230; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or $\frac{1}{2}$ unit.
331. **Experimental Psychology, II.** A lecture-laboratory course concentrating on research problems and methodology in both animal and human learning; concentration on laboratory techniques and reporting experimental results. Prerequisite: Psychology 248; a knowledge of statistics equivalent to that from Psychology 235. 4 hours or $\frac{1}{2}$ unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Sociology 332. Lecture and laboratory in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185. 4 hours, or $\frac{1}{2}$ or 1 unit.
333. **Research Methods in Social Psychology: Natural Settings.** Methods and techniques of social psychological research in natural settings. Students formulate and carry out research problems using procedures appropriate for research in natural settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235, or Sociology 184 and 185. 4 hours or 1 unit.
335. **Mathematical Formulations in Psychological Theory.** Illustration of mathematical formulations by studying quantitative treatments of various psychological processes; emphasis on learning theory, psychophysical laws, and other selected topics; and the development of simple mathematical tools as required. Prerequisite: Elementary statistics of probability, elementary calculus, and 6 hours of psychology, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Abnormal Psychology.** An introduction for preprofessional students to the psychological aspects of behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. Prerequisite: Six hours of psychology; junior

- standing except for those in the premedical curriculum who may take the course as second-semester sophomores with 4 hours of psychology, 3 hours, or $\frac{1}{2}$ or 1 unit.
339. **Community Psychology.** Introduction to the concepts and the application of psychological knowledge to community problems; stress on a broad definition of mental health, a social learning, and a preventive, rather than an ameliorative, approach to community problems; and emphasis on community organization and innovations in the delivery of services to those populations which normally fall outside the service network, e.g., the poor, minority groups, and other "marginal groups." Prerequisite: Sophomore standing; Psychology 100, 103, or 105. 3 hours, or $\frac{1}{2}$ or 1 unit.
 340. **Community Projects.** Principles of psychology applied to service problems in the community; students serve as nonprofessional mental health workers in supervised experiences in schools, hospitals, and other nontraditional settings. Prerequisite: Psychology 100 and 339; junior or senior standing; and consent of instructor. 4 hours or 1 unit.
 342. **Behavior-Genetic Analysis.** Same as Zoology 350 and Anthropology 342. Concepts, methods, and problems in the analysis of relations between genetic systems and animal and brain behavior. Prerequisite: Anthropology 240, Biology 210, or consent of instructor; consent required for enrollment in laboratory. 3 or 5 hours, or $\frac{3}{4}$ or 1 unit.
 345. **Comparative Psychology.** Animal behavior with particular reference to the behavior of vertebrates. Prerequisite: Six hours of psychology, or Psychology 100, 103, or 105; a course in zoology. 4 hours, or $\frac{1}{2}$ or 1 unit.
 347. **Behavior Genetics Laboratory.** Same as Anthropology 337. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Concurrent registration in Psychology 247. 2 hours or $\frac{1}{2}$ unit.
 348. **Theories of Learning.** A critical analysis of selected theories of learning; consideration of problems of theory construction in the context of past controversies in learning as well as recent theories of animal and human learning. Prerequisite: Psychology 248 or Educational Psychology 211. 3 hours, or $\frac{1}{2}$ or 1 unit.
 350. **Research and Theory in Personality.** Study of personality for the advanced student in psychology; consideration of problems of measurement, development, structure, dynamics, and change of personality; and study of examples of current theory and research as illustrations of an objective approach to the field. Prerequisite: Psychology 100, 103, or 105; Psychology 235 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit. Graduate credit is not given for both Psychology 350 and 441.
 352. **Attitude Theory and Change.** Same as Communications 352 and Sociology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Psychology 201 or Sociology 201, or a comparable course of introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
 353. **Individual Social Behavior.** Survey of major theories and research on perceptual, cognitive, learning, motivational, and environmental factors that influence the social behavior of the individual. Prerequisite: Psychology 201, 216, or 250, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
 354. **Interpersonal Processes.** The nature of interpersonal transactions; theories and methods for their investigation; and consideration of both individual and social determinants of such transactions. Prerequisite: Psychology 201. 3 hours, or $\frac{1}{2}$ or 1 unit.
 355. **Industrial Social Psychology.** Same as Labor and Industrial Relations 355. Social psychological research and theory applied to industrial problems; emphasis on interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or $\frac{1}{2}$ or 1 unit.
 356. **Human Factors in System Design.** Evaluation of the capabilities and limitations of human operators in the design of man-machine systems; applications of signal detection theory, information theory, servo theory, and Bayesian statistics to human sensing,

- monitoring, decision making, information processing, and communicating capabilities. Prerequisite: Psychology 258; one course in statistics or equivalent. 3 hours or 1 unit.
357. **Psychology of Industrial Conflict.** Same as Labor and Industrial Relations 357. An analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Offered in the special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit. Undergraduate majors in psychology may not receive credit in this course.
359. **The Social Psychology of Organization.** Same as Sociology 359. Analysis of the interrelationships between social and psychological factors and organizational structure and process; emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Psychology 355 or Sociology 322. 3 hours or 1 unit.
360. **Modern Viewpoints in Psychology.** A brief survey of early theoretical psychology followed by an examination of contemporary "behavior theory," Gestalt theory, and psychoanalytic theory as conceptions of man and as approaches to the study of learning, perception, personality, and social behavior. Prerequisite: Senior standing; 9 hours of psychology with an average grade of "B;" consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
361. **Advanced Developmental Psychology.** Theory and research on psychological development from birth through adolescence; maturation of behavior systems; the role of social learning in development; the effects of early experience on personality development; and critical stages in development. Prerequisite: Psychology 216 or 217; a course in statistics. 3 hours, or $\frac{1}{2}$ to 1 unit.
371. **Psychological Factors in Political Behavior.** An application of psychological methods and theories to the study of political behavior; attention to research methods and to content problems in voting behavior and national security policy. Prerequisite: Six hours beyond 100-level courses in psychology, political science, or sociology. 3 hours, or $\frac{1}{2}$ or 1 unit.
373. **Theory and Method in the Cross-Cultural Study of Individual Social Behavior.** Same as Anthropology 373. Centers on cross-cultural study of substantive areas such as personality, motivation, socialization, interpersonal behavior, psychological environments, cognition and cognitive development, ethnocentrism and stereotypes, and visual perception; emphasis on methodological limitations and contributions of cross-cultural study; and discussion of current problems and research. Prerequisite: Six hours of psychology or anthropology, or consent of instructor. 3 hours or 1 unit.
390. **Psychological Tests and Measurements.** The measurement of human behavior in psychological studies; the construction and use of psychological tests; introduction to tests of intelligence, achievement, personality, and interest; and practice in test construction, administration, and validation. Lectures and laboratory. Prerequisite: A knowledge of statistics equivalent to that from Psychology 235. 4 hours or 1 unit.
393. **Laboratory in Primate Social Behavior.** Same as Anthropology and Zoology 393. Introduction to the observational analysis of comparative primate communication and social behavior; instruction, discussion, and supervised practice in describing, classifying, and interpreting the social behavior of nonhuman primates. Each student is expected to perform a small individual laboratory project. Prerequisite: Anthropology 343 or Zoology 344, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.
396. **Seminar in Psychology.** Special topics in the field of psychology. Prerequisite: Junior standing and consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. The prerequisites stated below apply to graduate majors in psychology. Students minorng in psychology may, by special permission of instructors, enroll in certain of these courses without having met all the prerequisites.
402. **Systematic Psychology.** A critical analysis and comparison of modern and contemporary psychological systems. Prerequisite: Twelve hours of psychology. 1 unit.
408. **Design of Experiments in Psychology.** Advanced experimental designs in psychological research; special methods of data analysis. Prerequisite: Psychology 307. 1 unit.

409. **Psychological Scaling.** Same as Sociology 409. Scaling theory and methodology; emphasis on measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit.
411. **Advanced Physiological Psychology.** Detailed examination of the physiological mechanisms in behavior; emphasis on research methodology and contemporary literature in the physiology of motivation, learning, perception, and emotion; and includes laboratory demonstrations and problems. Prerequisite: Twelve hours of psychology, including Psychology 311 or equivalent. $\frac{1}{2}$ or 1 unit.
414. **Experimental Personality Research.** A laboratory training course emphasizing physiological, perceptual, learning, and genetic approaches to the experimental study of personality; critical surveys of recent research literature combined with laboratory training in representative techniques. Prerequisite: Psychology 307; consent of instructor. 1 unit.
415. **Experimental Sensory Psychology.** A systematic study of sensory processes, including vision, audition, gustation, olfaction, and somesthesia; emphasis on experimental methods, research findings, and theory. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.
416. **Perception.** Systematic study of methods and research findings in the field of human perception, together with an evaluation of theoretical interpretations. Prerequisite: Twelve hours of psychology. 1 unit.
417. **Experimental Psychology of Learning, I: Basic Processes.** Study of experimental investigation of basic learning processes; emphasis on the nature of the problems, experimental procedures, and theoretical significance. Prerequisite: Twelve hours of psychology. 1 unit.
418. **Experimental Psychology of Learning, II: Human Learning.** Data and theories of verbal learning; verbal mediators and their functions in learning and retention; transfer of training; short-term and long-term memory; and conceptualizations of the forgetting process. Prerequisite: Twelve hours of psychology or consent of instructor. 1 unit.
419. **Advanced Comparative Psychology.** A critical survey of techniques, results, and problems in the study of animal behavior and human behavior from the comparative-evolutionary point of view; laboratory demonstrations and individual research problems. Prerequisite: Twelve hours of psychology or biology. 1 unit.
424. **Developmental Psycholinguistics.** Same as Communications 424 and Linguistics 424. An advanced course on the acquisition of language. Prerequisite: Linguistics 325 or equivalent. 1 unit.
425. **Psycholinguistics.** Same as Communications 425 and Linguistics 425. A critical survey of methods and theories in the psychological study of the communication process; emphasis on linguistic, information-theory, and learning-theory approaches; psycholinguistic analysis of language decoding and encoding; and the development and measurement of symbolic processes, including meaning. Prerequisite: Consent of instructor. 1 unit.
426. **Research Seminar in Psycholinguistics.** Same as Communications 426 and Linguistics 426. Critical discussion of research problems to which psycholinguistic theories and techniques can be applied. Students taking this course plan, execute, and report an original piece of research in this area. Prerequisite: Psychology 425; consent of instructor. $\frac{1}{2}$ or 1 unit.
427. **Engineering Psychology.** Experimental psychology applied to the study of man-machine systems; study of psychological factors in the design of equipment, systems, and environments for safe, efficient, and comfortable performance by man. 1 unit.
428. **Higher Process.** Examination of method, theory, and research in the study of thinking; status of cognition as a construct; verbal control of behavior; concepts, problem solving, attention, language, and thought; and cognitive process as a source of motivation. Prerequisite: Twelve hours of psychology, including a laboratory course in experimental psychology. 1 unit.

429. **Second Language Acquisition and Bilingualism.** Same as Linguistics 429. Examination of the field from a psycholinguistic perspective; topics discussed include first versus second language acquisition; the nature of language aptitude and competence; methods of second language teaching; the nature of bilingualism; and comparative psycholinguistics. Prerequisite: Consent of instructor. 1 unit.
431. **Psychological Measurement in Industry.** Application of psychometric methods and the finding of differential psychology to the selection, classification, and performance evaluation of industrial personnel. Prerequisite: Psychology 307 or equivalent. 1 unit.
435. **Motivation and Morale in Industry.** Same as Labor and Industrial Relations 435. Concepts and methods in the study of motivation of employees; determinants of employee attitudes and job satisfaction; and modification of attitudes and morale. Prerequisite: Four units of graduate credit in psychology or consent of instructor. 1 unit.
436. **Mathematical Models in Psychology.** Recent developments in mathematical models in psychology; special emphasis on human learning, higher processes, and modern psychophysics. Prerequisite: One year of calculus and Psychology 306 and 307, or consent of instructor. $\frac{1}{2}$ or 1 unit.
438. **Introduction to Clinical Psychology, I.** Introduction to clinical psychology as a science and profession; lectures, discussion, demonstrations, and field observations provided for an overview of clinical psychology. Prerequisite: Graduate standing in clinical psychology; consent of instructor. 1 unit.
439. **Introduction to Clinical Psychology, II.** Continuation of introductory sequence in clinical psychology; discussion of logical issues in assessment, disposition, and behavior change; and initiation of preliminary training in interview and observational methods. Prerequisite: Psychology 438. 1 unit.
440. **Functional Analysis of Behavior.** A lecture and laboratory course in the principles, analysis, and control of behavior; emphasis on operant and respondent conditioning as means of behavior change. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
441. **Personality and Behavior Dynamics.** Description of the cross-sectional structure of personality, the basic principles of behavior dynamics, and the determinants which shape personality development; special topics include typologies, trait measurement, conflict and anxiety, and mechanisms of defense. Prerequisite: Twelve hours of psychology. $\frac{1}{2}$ unit. Graduate credit is not given for both Psychology 350 and 441.
442. **Behavior Disorders.** A review of the experimental-clinical literature concerning behavior disorders, with special reference to classification and etiology. Prerequisite: Psychology 338 and 440; consent of instructor. $\frac{1}{2}$ unit.
443. **Psychodiagnostics, I.** Instruction and practice in the administration and interpretation of individual tests of general intelligence, special abilities, and achievement. Prerequisite: Twelve hours of psychology, including Psychology 390 or equivalent; Psychology 439. 1 unit.
444. **Psychodiagnostics, II.** Instruction and practice in the administration and interpretation of tests and other instruments used in the assessment of personality; special emphasis on projective techniques. Prerequisite: Psychology 443; consent of instructor. 1 unit.
445. **Behavior Modification.** A critical survey of issues, principles, practice, and research related to modifying human behavior; covers psychotherapeutic and somatic approaches; symptomatic relief and personality-restructuring; goal-orientations; and individual family, group, milieu, and preventive community intervention. Prerequisite: Psychology 444; concurrent registration in Psychology 447 strongly recommended. $\frac{1}{2}$ unit.
446. **Laboratories in Clinical Psychology.** Intensive practice in techniques of clinical assessment and behavior modification with emphasis on recent innovations; small sections of the course formed according to the specialized interests of students and staff. Prerequisite: Psychology 445. $\frac{1}{2}$ to 1 unit.
447. **Internship.** Supervised field experience in clinical psychology. Prerequisite: Consent of instructor. 0 to 4 units.
449. **Medicine in Clinical Psychology.** Introduction to areas of medicine and the organization of medical services as appropriate to the practice of clinical psychology; presenta-

tion of medical facts, procedures, and viewpoints to enhance the mutual contributions and collaborative efforts of medicine and clinical psychology. Prerequisite: Second-year graduate standing in clinical psychology or consent of instructor. ½ unit.

451. **Theory and Method in Social Psychology, I.** First of two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology; participation and seminar presentations by social psychology program faculty. Student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Admission as a graduate student to the social psychology program, or consent of instructor. 1 unit.
452. **Theory and Method in Social Psychology, II.** Second of a two-course sequence for first-year graduate students in social psychology. Advanced theoretical and research approaches to a broad range of issues in social psychology; participation and seminar presentations by social psychology program faculty. Each student participates in seminar presentations and develops and conducts a research study in conjunction with one or more faculty members. Students should register concurrently in Psychology 490. Prerequisite: Psychology 451. ½ unit.
453. **Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Sociology 456. Introduction to the principal theories and important empirical research in various disciplines that study organizations; critical examination of the capacities and limitations of the various fields to make contributions to the study of organizations, in addition to examination of the subject matter content of various disciplines. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program or approval of instructor. 1 unit.
455. **Research Methods in Organizational Psychology.** Discussion and analysis of strategies, methods, and techniques of organizational psychological research; emphasis on methods for researching behavioral determinants within interdependent organizational roles. Prerequisite: Psychology 355 or 359, or consent of instructor. 1 unit.
456. **Attitude Measurement and Behavioral Prediction.** Same as Communications 456. Comprehensive examination of the theory and method of attitude measurement and its implications for behavioral prediction; emphasis on the attitude concept and the validity of behavioral criteria. Prerequisite: Two units in social psychology and a course in statistics, or consent of instructor. 1 unit.
457. **Theory and Research in Organizational Psychology.** Theory and research on the psychological processes involving the demands of organizations on the behavior of individuals; emphasis on the processes of power, authority, influence, leadership, communications, decision making, and organizational change. Prerequisite: Psychology 455 or consent of instructor. 1 unit.
458. **Advanced Problems in Attitude Research.** Intensive analyses of recent developments in attitude theory and research; emphasis on the attitude-behavior relationship; and examination of theories of attitude and attitude change with respect to their utility in predicting and changing social behavior. Prerequisite: Psychology 352 or 456. 1 unit.
459. **Advanced Problems in Research on Groups.** Intensive examination of current research and theory on structure, process, and performance of groups; critical examination of recent research and theoretical literature; and development of research designs for related issues in the field. Prerequisite: Psychology 451 or consent of instructor. 1 unit.
460. **Motivation and Personality Development in Children.** Theory, method, and research on the interaction of motivational, personality, and learning processes and development in children; emphasis on experimental studies and a social learning theory approach. Class projects involve some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
462. **Human Abilities.** Analysis of individual differences in human abilities, including historical background, measurement methodology, and functional correlates of abilities;

consideration of the use of ability measures in both experimental and applied research. Prerequisite: Psychology 307 or equivalent. 1 unit.

463. **Research Methods in Clinical Psychology and Personality.** The logical analysis of clinical inferences and their role in research; problems and methods in the investigation of the development, dynamics, and structure of personality; and research in psychotherapy. Prerequisite: Psychology 306. ½ unit.
464. **Advanced Problems in the Study of Individual Social Behavior.** An intensive examination of current research into one or more of the following areas: social perception and cognition, social motivation, social learning, and environmental factors in social behavior; critical examination of recent research and theoretical literature, and development of research designs for selected current issues. Prerequisite: Psychology 451; 6 units of psychology. 1 unit.
465. **Learning in Children.** Examination of laboratory investigations of children's learning; emphasis on developmental changes as related to current theories of learning and development; and class projects involving some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
466. **Advanced Personality Theory.** An integration of concepts arising from quantitative, multivariate, and experimental research on personality and requiring facility with precise models; deals with measurement, personality and motivation structure, genetics, physiological determiners, models for family and cultural relations, and structured learning theory; and considers implications of personality theory in clinical, industrial, and educational psychology. Prerequisite: Psychology 306 and 307. 1 unit.
467. **Personality Assessment.** Methods and theory in the quantitative assessment of personality; review of research findings and trends. Prerequisite: Psychology 307 or equivalent. 1 unit.
468. **Contemporary Behavior Theory.** Introduction to modern attempts to formulate scientific theories of behavior; special emphasis on theories concerning the learning process, including the work of Hull, Tolman, and Guthrie. Prerequisite: Six units of graduate credit in psychology; consent of instructor. 1 unit.
469. **Cognitive Development.** Examination of laboratory investigations of cognitive development in children; emphasis on current theories of cognition and language; and class projects involving some laboratory work with children. Prerequisite: Twelve hours of psychology; consent of instructor. 1 unit.
470. **Principles and Methods of Teaching Psychology.** Designed for graduate students in psychology; areas considered include developing course objectives and content; developing and presenting teaching-learning situations; evaluating the attainment of course objectives; advising and counseling students; ethics in teaching; and research problems on the teaching of psychology. Prerequisite: Second-year graduate standing in psychology or consent of instructor. ½ or 1 unit.
483. **Psychology of Speech and Hearing Disorders, I.** Same as Speech and Hearing Science 483. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to speech disorders; review of research finding and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
484. **Psychology of Speech and Hearing Disorders, II.** Same as Speech and Hearing Science 484. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
485. **The Sampling of Human Populations and Social Organizations.** Same as Business Administration 435 and Sociology 485. Covers procedures for selecting samples from and estimating population parameters for human populations and social organizations; treatment of types of sample designs including simple random samples, and stratified and cluster samples, together with random number and systematic selection techniques; and emphasis on the study of various kinds of advanced sample designs for both

area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or consent of instructor. 1 unit.

490. **Individual Research.** For graduate students who wish to conduct research on special problems not included in graduate theses. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
492. **Psychology of Learning and Instruction.** Same as Educational Psychology 492. An advanced course in the nature and conditions of long-term cognitive learning and retention in classroom and similar situations; intended for doctoral students with a special interest in research leading to the improvement of classroom teaching and learning, in psychological aspects of curriculum research, and in the cognitive aspects of military and industrial training. Prerequisite: Consent of instructor. 1 unit.
493. **Seminar.** Discussion of current topics in their historical setting, with special emphasis on research problems. Prerequisite: Six units of graduate credit in psychology; consent of instructor. $\frac{1}{2}$ or 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Educational Psychology 494 and Sociology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements; emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
495. **Theories of Measurement.** Same as Educational Psychology 495. Classical test theory (true score, error of measurement, reliability and validity of test scores, composite measures); proposed alternatives to the classical model (generalizability theory, matrix sampling, latent trait theory, criterion-referenced measurement). Prerequisite: Educational Psychology 496 or Psychology 307, or equivalent; Educational Psychology 392 or Psychology 390, or equivalent. 1 unit.
499. **Thesis Research.** 0 to 4 units.

RADIO AND TELEVISION

Head of Department: Professor P. E. Welch

Department Office: 119 Gregory Hall, Urbana

199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
252. **Television Laboratory.** Designed to acquaint the student with basic television equipment and principles of studio operation; emphasis on the production of laboratory programs with students participating in the various jobs involved in studio production. Prerequisite: Consent of department. 3 hours.
261. **Principles of Radio and Television Broadcasting.** An introductory course in the history of American radio and television broadcasting; comparative broadcasting systems; organization and operation of stations and networks; social and legal responsibilities of radio and television; codes and practices of broadcasting; and an introduction to radio and television audience measurement and survey methods. Prerequisite: Junior standing. 2 hours.
263. **Radio and Television Announcing.** Intensive training in studio procedures and interpretation of radio and television copy, including news, feature scripts, continuity, and commercials. Prerequisite: Consent of department. 2 hours.
267. **Radio Production and Direction.** Study of the principles of planning, casting, rehearsing, and airing varied program types; emphasis on advanced techniques of dramatic production. Prerequisite: Consent of department. 3 hours.

280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Speech Communication 263, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.
291. **Special Problems.** Special projects, research, and independent reading in radio and television for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of department. 2 or 3 hours.
354. **Television Directing.** The theory and techniques of directing the television program; experience in directing laboratory productions. Prerequisite: Radio and Television 252; consent of department. 3 hours or ½ unit.
355. **Television News.** News coverage, script preparation, use of visual materials, and presentation of news programs; attention given to interviews, special events, and news fields of special interest. Prerequisite: Journalism 211; consent of department. 3 hours or ½ unit.
356. **Cinematography for Television.** The equipment and techniques used in the production of films for television, including camera operation, lighting, editing, sound recording, matching, etc. For current fees, see *Timetable*. Prerequisite: Consent of department. 3 hours or ½ unit.
357. **Broadcast Continuity Writing.** Study of the fundamentals of radio and television continuity writing, including commercial copy, talks, interviews, and music and feature programs. Prerequisite: Consent of department. 3 hours or ½ unit.
360. **Educational Uses of Television and Radio.** Same as Educational Psychology 360. Study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; and experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.
361. **Television Programs.** Television program history; types, structure, formats, and basic audience appeals; major emphasis on the creative aspects of originating and planning television programs. Prerequisite: Course or experience in television directing and production; consent of department. 3 hours or ½ unit.
362. **Radio and Television Station Management.** Study of the organization and administration of the radio and television staff and station; public relations, personnel management, and station operation; analysis of station and agency relationships, and radio and television sales procedures; methods and media for program and station promotion; and laws and regulations affecting management, financing, and labor relationships. Prerequisite: Radio and Television 261; senior standing; consent of department. 2 hours or ½ unit.
363. **Advanced Dramatic Writing.** Same as Speech Communication 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Radio and Television 280; consent of instructor. 3 hours, or ½ or 1 unit. May be repeated to a maximum of 6 hours or 2 units.
365. **Radio News.** News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services; and processing radio news-service copy. Prerequisite: Journalism 211; consent of department. 3 hours or ½ unit.
366. **Advanced Radio and Television Practices, I.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or ½ unit.
367. **Advanced Radio and Television Practices, II.** Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, produc-

tion and direction, and writing. Prerequisite: All courses in area of specialization; consent of department. 2 hours or $\frac{1}{2}$ unit.

- 368. Radio and Television Regulations.** Federal legislation, with emphasis on Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. Prerequisite: Consent of department. 2 hours or $\frac{1}{2}$ unit.
- 450. Special Problems in Television.** Project work for advanced students in specific areas of television, including news, advertising, directing, writing, etc. Prerequisite: A television course in the area of specialization; consent of department. $\frac{1}{2}$ to 3 units. A maximum of 3 units permitted toward degree.
- 462. Seminar in Radio and Television.** Same as Communications 462. Study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. Prerequisite: Consent of department. 1 unit.
- 463. World Broadcasting.** Same as Communications 463. Study of the broadcast systems used by the nations of the world; alternative and "mixed" systems; international organizations, agreements, exchanges, and problems; broadcasts to and from other countries; implications of such new developments as satellites; and mass and nonmass uses. Prerequisite: Consent of department. 1 unit.
- 490. Special Topics in Radio and Television.** Prerequisite: Consent of department. $\frac{1}{2}$ or 1 unit.
- 499. Thesis Research.** Prerequisite: Graduate standing in radio and television. 1 or 2 units.

RELIGIOUS STUDIES

(See Humanities, School of)

RHETORIC AND COMPOSITION

(See English under Humanities, School of)

ROMANCE LINGUISTICS

(See Spanish, Italian, and Portuguese under Humanities, School of)

RURAL SOCIOLOGY

(See Agricultural Economics)

RUSSIAN

(See Slavic Languages and Literatures under Humanities, School of)

SAFETY EDUCATION

(See Health and Safety Education)

SANSKRIT

(See Asian Studies)

SCANDINAVIAN

(See Germanic Languages and Literatures under Humanities, School of)

SECONDARY EDUCATION

Chairperson of Department: Professor I. D. Westbury
Department Office: 395 Education Building, Urbana

101. **Introduction to the Teaching of Secondary School Subjects.** A survey of recent developments in the teaching of secondary school subjects; assesses standard and new programs; and explores research and empirical evidence as they relate to effective teaching of secondary school subjects. Special sections are provided in the usual secondary school fields. 2 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
240. **Principles of Secondary Education.** Provides each specialized educational worker with a common orientation to the major responsibilities of the public school as a unit and to the educational worker's own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Secondary Education 101; Psychology 100. 2 hours.
241. **Techniques of Teaching in the Secondary Schools.** Same as Health Education 241. Methods of teaching specific subject matter fields in the secondary school; special sections provided in the usual high school subjects. Prerequisite: Educational Policy Studies 201; Secondary Education 240; concurrent registration in Educational Practice 242; consent of instructor. This course meets only during the first eight weeks of the semester. 3 to 5 hours.
247. **Teaching of Speech.** Same as Speech Communication 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 or 3 hours.

291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
317. **Computer-Assisted Instruction.** Same as Computer Science 317. Computer-assisted instruction (CAI) and its relation to classroom teaching; the teacher's role in development, management, and criticism of CAI lessons; treatment of topics including instructional capabilities of CAI systems, instructional programming, and the design of CAI lessons. Prerequisite: Any Computer Science 100-level programming course, or consent of instructor. 4 hours or 1 unit.
336. **Fundamentals of Reading Techniques.** Same as Elementary and Early Childhood Education 336. Basic principles, techniques, and materials for the developmental reading program; emphasis on methods and materials that provide for differentiated instruction. Prerequisite: Junior standing; concurrent registration in a teacher education curriculum. 3 hours, or $\frac{1}{2}$ or 1 unit.
338. **Teaching of Reading in Grades Four Through Twelve.** Same as Elementary and Early Childhood Education 338. Developmental reading programs beyond the primary grades; factors related to reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary and Early Childhood Education 336 or Educational Psychology 211; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Audio-Visual Communication.** Same as Elementary and Early Childhood Education 354 and Library Science 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process; the selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
356. **The Computer and Mathematics Education.** Surveys the role of the computer as an educational tool with an emphasis on applications for teaching precollege mathematics; analysis of computational problems and development of algorithms for their solution; iteration, nonlinear interpolation, and Monte Carlo methods; computer-assisted instruction; individually prescribed instruction; modular scheduling; information retrieval; library programs; and natural language analysis. Prerequisite: Computer Science 101 or 400, or consent of instructor. 4 hours or 1 unit.
399. **Issues and Developments in Secondary Education.** A seminar on topics not treated by regularly scheduled courses; requests for initiation may be made by students or faculty members. Prerequisite: Junior standing. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
439. **Fundamentals of Curriculum Development.** Same as Elementary and Early Childhood Education 439. Explores the several theoretical bases of curriculum planning and the implications of these approaches for practice. 1 unit.
441. **Linguistic and Logical Analysis of Teaching.** An analysis of teaching from the standpoint of semantic and logical factors; discussion of topics such as theories of meaning, definition, explanation, and justification as employed by a teacher. 1 unit.
448. **Continuing Education Program Development.** Same as Administration, Higher, and Continuing Education 448 and Vocational and Technical Education 448. Analysis of the process of planning and conducting continuing education programs for adults; includes theory, research, and practice regarding sponsors, need appraisal, objectives, selection and organization of learning activities, and evaluation. Recommended for majors in continuing education. Prerequisite: Consent of instructor. Administration, Higher, and Continuing Education 362 is recommended, especially for majors in continuing education. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may

be offered toward an advanced degree except by consent of the dean of the College of Education.

456. **Problems and Trends in Specialized Fields of Secondary Education.** An intensive examination of problems and trends in the subject fields of the secondary school. Sections are usually offered in the following areas: English language and literature, mathematics, physical and biological sciences, social science, bilingual-bicultural education, physical education, and music. 1 unit.
459. **Workshop in Curriculum Development.** An intensive exploration of curriculum development projects in specialized areas of secondary education. ½ to 2 units.
490. **Seminar for Advanced Students of Education.** Intensive examination of theoretical and policy issues in secondary education. Sections are usually offered in the following areas: curriculum policy and research, teacher education, English language and literature, mathematics, physical and biological sciences, social science, music, bilingual-bicultural education, and instructional applications of computers. Prerequisite: Admission to doctoral study in secondary education. 0 to 1 unit. May be repeated to a maximum of 2 units.
491. **Field Study and Thesis Seminar.** Explores the identification and evaluation of research topics and problems in secondary education. Prerequisite: Admission to doctoral study. 1 to 2 units. May be repeated to a maximum of 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

SERBO-CROATIAN

(See Slavic Languages and Literatures under Humanities, School of)

SLAVIC

(See Slavic Languages and Literatures under Humanities, School of)

SOCIAL WORK

Director of School: Professor D. Brieland

School Office: 1207 West Oregon Street, Urbana

100. **Contemporary Social Work.** A broad survey of the field of social welfare; introduction to social services, social welfare organizations, major social problems and target population groups, and the methods employed in service to individuals, groups, and communities; and includes the range of personnel and skills in social work agencies, and the means of education and training for social work. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
290. **Honors Seminar.** A series of lectures, student presentations, and discussions on selected topics in social welfare. Prerequisite: Completion of 12 hours in social welfare courses; senior standing; 4.0 grade-point average in courses included in social welfare; and consent of instructor. 2 to 4 hours. May be repeated to a maximum of 4 hours.
298. **Practice Seminar.** Critical examination of the application of knowledge to social work practice; emphasis on reciprocal relationships between personal problems and needs, social environment, agency services, and helping methods; and consideration of new trends in practice and empirical knowledge. Prerequisite: Social work major; consent

- of undergraduate field instruction coordinator; concurrent registration in Social Work 299. 3 hours.
299. **Field Instruction.** The student is assigned to field instructors for learning experiences in social agencies and communities; experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele and communities. Prerequisite: Social work major; consent of undergraduate field instruction coordinator. 6 to 12 hours.
300. **Methods of Social Work Intervention, I.** Examination of the methods of social work intervention (casework, group work, and community organization) utilized in various social work agencies and social welfare settings; emphasis on understanding of the values, knowledge, principles, and processes of social work practice. Prerequisite: Admission to B.S.W. or M.S.W. program, or consent of instructor. 3 hours or 1 unit.
301. **Methods of Social Work Intervention, II.** Skill development and practice in social work with individuals, families, and small groups, within a community and organizational context; emphasis on target groups and agency settings. Prerequisite: Social Work 300. 3 hours or 1 unit.
303. **Delivery of Health Care: Problems and Perspectives.** Same as Health Education 303. The wide range of factors--ecological, social, cultural, medical, organizational, economic, and political--which influence health care in a complex nation like the United States; attention to perspectives from various fields of study. Prerequisite: Junior standing and consent of instructor. 3 hours or 1 unit.
310. **Social Welfare Policy and Services, I.** Critical study of the income maintenance system in the United States as a response to the problems of inequality of opportunity and income, poverty, and income security; consideration of alternative approaches with discussion of the social worker's role in the system. Prerequisite: Admission to social welfare major or minor, or graduate standing. 3 hours or 1 unit.
311. **Social Services Policy and Services, II.** Critical evaluation of social policy and services in selected problem areas; includes the process of social policy analysis, current issues in funding and monitoring of personal social services, and strategies for dealing effectively with social problems. Prerequisite: Credit or concurrent registration in Social Work 310. 3 hours or 1 unit.
312. **Racial Minorities and Social Welfare.** Social welfare problems, history of self-help institutions, and development of formal social provisions in relation to racial minority groups and the minority status of individual clients; emphasizes indigenous change movements. Prerequisite: Admission to B.S.W. or M.S.W. program. 3 hours or 1 unit.
313. **Social Services for Health and Rehabilitation.** The psychological and sociological impact of illness and disability on the individual, the family, and the community, emphasizing the social worker's role in medical and rehabilitation settings. Prerequisite: Admission to B.S.W. or M.S.W. program, or consent of instructor. 3 hours or 1 unit.
314. **Social Services in Mental Health and Retardation.** Examination of comprehensive community mental health services as they evolve from definitions of the problems and changes in federal and state social policy; the concept of normalization and its criteria for program evaluation; and changing roles of mental health professionals, paraprofessionals, and consumers in policy making and service delivery. Prerequisite: Admission to B.S.W. or M.S.W. program, or consent of instructor. 3 hours or 1 unit.
315. **Social Work Services for the Aged.** The social needs of older people in the context of developing services and income transfer benefits; identifies major issues in social service delivery; and reviews methods of intervention on behalf of older people in terms of both skill required and policy implications. Prerequisite: Admission to B.S.W. or M.S.W. program, or consent of instructor. 3 hours or 1 unit.
316. **Social Services for Children and Families.** Child and family welfare policies and practice in relation to social services which support, supplement, or substitute for parental care of children; practice and policy issues in relation to the state's responsibility for guardianship, juvenile court, employment of children and young persons, and regulation of child-care facilities; and consideration of trends and issues in family and child

- welfare planning. Prerequisite: Admission to B.S.W. or M.S.W. program, or consent of instructor. 3 hours or 1 unit.
317. **Social Work and Corrections.** The problems of crime, characteristics of offenders, and components of the criminal justice system as a foundation for social work practice in correctional settings. Prerequisite: Admission to B.S.W. or M.S.W. program, sociology major, or consent of instructor. 3 hours or 1 unit.
318. **Special Problems.** A small group seminar for independent study of a topic or topics of special interest in the field of social welfare; emphasis on examination and discussion of significant and current social welfare issues and problems. Prerequisite: Credit or concurrent registration in Social Work 300; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
319. **Social Work and the Public School.** Social work services in schools as a process in school-community-pupil relations; focuses on the school as a social system; and includes education as a continuum from preschool to adulthood, financing and other major problem areas, sociolegal issues which affect equality of education and pupil welfare, and some current educational innovations. Prerequisite: Graduate standing in social work or consent of instructor. 3 hours or 1 unit.
320. **Social Perspectives in Day Care.** Day care for children within a social context; day care institutions from the perspective of history, current issues, methods of operation, social work involvement, problems, and politics. Prerequisite: Admission to interdisciplinary day-care program or consent of instructor. 3 hours or 1 unit.
327. **Research Methods in Social Work Practice.** Objectives of research pertaining to social work practice; design of experiments; measurement and methods of collecting data; design of questionnaires and schedules; methods of data analysis including statistical hypothesis testing and applications of inferential techniques; interpretation of results; and preparation of reports. Prerequisite: An introductory course in statistics and admission to social welfare major, or graduate standing. 3 hours or 1 unit.
345. **Family Planning and Population Policy.** Same as Health Education and Sociology 345. Background information for professionals involved in the field of family planning; includes historical and current trends in developing and developed nations, with emphasis on the United States; and examines family planning and population policies, and programs and contraceptive methods as related to service delivery and to professional roles. Prerequisite: Consent of instructor. 3 hours or 1 unit.
351. **Human Growth and Behavior, I.** The major forces influencing the growth and behavior of the individual from birth through adulthood; sociocultural, familial, physical, emotional, and intellectual factors as they enhance or retard social functioning; the nature and dynamics of social process as related to growth and behavior; and the relevance of this content to social work practice. Prerequisite: Admission to B.S.W. program. 3 hours or 1 unit.
400. **Comparative Analysis of Approaches to Casework.** Systematic and critical examination of selected approaches, conceptualizations, procedures, and techniques in casework theory and practice; includes the employment of a framework for the analysis and assessment of the various approaches, study of research related to process and outcome, and identification of practice issues. Prerequisite: Social Work 300. 1 unit.
401. **Comparative Approaches to Social Group Work Practice.** Social work practice theory in social group work through comparative study of various practice approaches; includes the utilization of the group work method in contemporary social work practice, practice principles, and the use of group process. Prerequisite: Social Work 300. 1 unit.
402. **Comparative Approaches in Community Organization Practice.** Principles and methods which characterize identifiable approaches used in community organization practice at neighborhood, community, state, and other levels. Prerequisite: Graduate standing in social work; Social Work 300 or consent of instructor. 1 unit.
403. **Advanced Practice in Psychosocial Treatment.** Provides opportunities for students to learn and use advanced knowledge of psychodynamics and psychopathology in formulating a psychosocial assessment and treatment strategy in social work settings; empha-

- sis on transferring such knowledge to advanced social work practice skills. Prerequisite: Credit or concurrent registration in Social Work 400. 1 unit.
- 404. Seminar and Practicum in Clinical Group Work.** Exploration of concepts and issues related to integrity and encounter groups, self-help groups, and group psychotherapy; provides experience in an intensive encounter based on a structured, contractual integrity group; and emphasizes development of self-awareness, interpersonal skill, and leadership in facilitating clinical groups. Prerequisite: Social Work 401 or equivalent. 1 unit.
- 405. Behavior Modification in Social Work.** Examination of conceptual ideas about behavior modification for their usefulness in working with clinical problems of concern to the social worker; focuses on intervention with individuals and families and the application of behavioral principles in working with groups, institutions, and communities; and emphasizes the development of a systematic approach for applying behavior modification principles in actual practice situations. Prerequisite: Social Work 300. 1 unit.
- 407. Intervention Strategies for Institutional Change.** Generic social work strategies used for institutional change, emphasizing problems and issues in the public schools. Prerequisite: Social Work 319 or consent of instructor. 1 unit.
- 420. Social Welfare Planning.** Examination of the interactional, interpersonal, and political aspects of social welfare planning in a variety of settings and under a number of auspices; formulation of models for social welfare planning. Prerequisite: Admission to M.S.W. program or consent of instructor. 1 unit.
- 421. Community Program Planning.** Definition of a problem of significant concern to a public social welfare agency; collection of data, gathering of opinions, and testing the feasibility of service options; and formulation of a program of service to ameliorate the problem. Prerequisite: Admission to M.S.W. program or consent of instructor. 1 unit.
- 426. Social Welfare Administration.** Principles and process of administration and management of social welfare organizations, including review of organization theory, policy formulation, agency structure and staff organization, and budgeting. Prerequisite: Admission to M.S.W. program or consent of instructor. 1 unit.
- 427. Service Accounting in Social Welfare.** Examines different types of services, to whom they are provided at what costs and with what results; within a systems perspective, considers methods of describing, reporting, and measuring client and target population characteristics, services, and resources; and includes allocation of scarce resources among competing demands and practice in specific methods. Prerequisite: Social Work 327 or equivalent. 1 unit.
- 428. Family Therapy Seminar and Practicum.** The principles, issues, and practices of family therapy; examines and compares major theoretical concepts; and enables students to learn how to do family therapy by studying theory and applying it in an actual practice experience. Prerequisite: Social Work 400 or consent of instructor. 1 unit.
- 431. Practice Seminar, I.** Critical examination of the application of knowledge to social work practice; emphasis on reciprocal relationships between personal problems and needs, social environment, agency services, and helping methods; and consideration of new trends in practice and empirical knowledge. Prerequisite: Concurrent registration in Social Work 468 or consent of instructor. 1 unit.
- 432. Practice Seminar, II.** Critical examination of the application of knowledge to social work practice; emphasis on relationships between personal problems, social problems, planning processes, and agency purposes and functions; and consideration of trends in social policy and empirical knowledge. Prerequisite: Concurrent registration in Social Work 469 or consent of instructor. 1 unit.
- 435. Supervision/Consultation/Staff Development.** The philosophy, objectives, principles, and methods of social work supervision, consultation, and training for staff development; analysis of similarities and differences in roles, knowledge, and skills required with emphasis on the teaching-learning-evaluating components; and issues arising from agency setting, changing legislation and program provisions, and relationships to social

welfare administration. Prerequisite: Graduate standing in social work or consent of instructor. 1 unit.

452. **Human Growth and Behavior and the Social Environment, II: Psychosocial Disorders.** Interrelationship of physical, emotional, learning, and social aspects of behavior disorders, and implications for the patient, family, and community; psychopathology, including neuroses, psychoses, character disorders, organic conditions, psychophysiologic disorders, and mental retardation; and diagnosis and treatment methods, including psychotherapy, somatic and drug therapies, and social work. Prerequisite: Social Work 351. 1 unit.
461. **Special Studies in Social Work, I.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
462. **Special Studies in Social Work, II.** Independent or group study in areas of special interest; application of social work principles to special problems or settings. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 2 units.
468. **Field Instruction, II.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Consent of instructor. 1 to 2 units.
469. **Field Instruction, III.** The student is assigned to field instructors for learning experiences in social agencies and communities. Such experiences include the use of knowledge and understanding in analyses of case and problem situations and in direct service to agency clientele. Prerequisite: Social Work 468. 1 to 2 units.
484. **National Social Welfare Policy, I.** A macroanalysis of income maintenance policies; includes policy alternatives and contrasting conceptualizations of the problems of poverty, income inequality, and economic insecurity. Prerequisite: Social Work 310 or consent of instructor. 1 unit.
485. **National Social Welfare Policy, II.** Emphasis on the case approach within the context of basic political and governmental processes which influence the development, enactment, and application of national policy; analytical study of the background, legislative history, amendments, judicial interpretations, and operation of major national acts comprising our national social welfare policy, or bearing directly on social welfare such as the Social Security Act, the Employment Act, the Civil Rights Acts, and the Economic Opportunity Act. Prerequisite: Social Work 484 or consent of instructor. $\frac{1}{2}$ to 2 units.
488. **International Social Welfare.** Methodologies of comparative study; social welfare policies and programs in selected foreign countries; and special attention to foreign programs which provide data on American issues. Countries chosen vary. Prerequisite: Consent of instructor. 1 unit.
489. **Social Work and the Law.** Legal procedures and issues of special relevance to social work practice; includes legal provisions related to poverty, family development and crises, racial and ethnic minorities, institutionalized persons, crime and delinquency, legal authority of social agencies, and regulation of the profession. Prerequisite: Graduate standing in social work or consent of instructor. 1 unit.
491. **Research Seminar.** Seminar for students preparing research projects, either in groups or individually; experience in the application of research methods to current social work problems. Prerequisite: Social Work 327 or equivalent. 0 to 2 units.
492. **Seminar on Models for Directed Change.** Same as Sociology 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels; construction of models as interpretations of behavioral science theory; extrapolation of hypotheses and of guides to intervention from the models; and readings from several disciplines as relevant. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
493. **Seminar: Design of Social Work Research.** Issues and problems in social work research; includes proof and verification, generalizability, and use of scaling and of judg-

- ments; and design of original research study. Prerequisite: Admission to D.S.W. program and Social Work 327, or consent of instructor. 1 unit.
497. **Collective Bargaining in Public Employment.** Same as Labor and Industrial Relations 497, Administration, Higher, and Continuing Education 497, and Political Science 469. Development of employee organization, collective bargaining, and public policies in the public sector: federal, state and local; analysis of contemporary bargaining relations, procedures, problems, and consequences. Prerequisite: Consent of instructor. 1 unit.
499. **Thesis Research.** Research and writing of doctoral thesis. 0 to 5 units.

SOCIOLOGY

Head of Department: Professor B. Karsh

Department Office: 326 Lincoln Hall, Urbana

100. **Introduction to Sociology.** Introductory analysis and description of the structure and dynamics of human society; special emphasis on the application of scientific methods to the observation and analysis of social norms, groups, intergroup relations, social change, social stratification, and institutions. 3 hours.
131. **Social Problems.** Introductory survey of sociological aspects of chief modern social problems; stress on the social interrelationships and cultural conflicts involved in their genesis, significance, and amelioration or prevention. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
184. **Nonstatistical Introduction to Social Science Research Methods.** Emphasis on the formulation of social science issues as research questions, the various types of research methods and their advantages and disadvantages, the design of research programs, the analysis and appraisal of research findings, and research reporting; critical examination of major studies in sociology, political science, and anthropology. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.
185. **Introduction to Social Statistics.** Same as Geography 185. A first course in social statistics for students without mathematics beyond the high school level; topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or 6 hours in sociology, political science, anthropology, or geography. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
201. **Introduction to Social Psychology.** An introduction to the study of relationships between the functioning of social systems and the behavior and attitudes of individuals; special reference to social and cultural factors in personality development and perceptual processes, and to role behavior and small group interaction. Credit is not given for both Sociology 201 and Psychology 201. Prerequisite: Sociology 100. 3 hours.
202. **Sociology of Poverty.** Analysis of institutional structures which tend to maintain poverty in industrialized societies, particularly the United States, in the context of social stratification. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
206. **Political Sociology.** An examination of the social contexts of political behavior, including behavior within formal organizations such as trade unions, the formation and maintenance of elite groups, and the development of movements for political change; focus chiefly on the informal processes that impinge upon and occur within different institutions, illuminating such processes by reference to materials on political behavior in the United States as well as in other nations. 3 hours.

208. **Collective Political Violence.** The study of the causes, processes, and effects of collective violence, particularly of riots, coups, and revolution. Prerequisite: Sociology 100. 3 hours.
212. **Culture Patterns and the Individual.** Relationships between institutional structure and culture patterns and the common drives, attitudes, and other adjustive mechanisms of the group members. Prerequisite: Sociology 100; junior standing. 3 hours.
219. **Comparative Study of Societies.** Introduction to crossnational comparative sociology; theories of society in comparative perspective and problems of collecting data in other societies; and detailed discussion of a selected research topic in a comparative context. Prerequisite: Sociology 100 or consent of instructor. 3 hours.
221. **Contemporary Society.** Basic character of modern life forms; underlying principles and efforts at reorientation. Prerequisite: Sociology 100; junior standing. 3 hours.
222. **Introduction to Modern Africa.** Same as African Studies, Anthropology, and Political Science 222. An interdisciplinary introduction to Africa dealing with basic themes and problems in African politics, economics, sociology, anthropology, and history. 3 hours.
223. **Stratification and Social Classes.** Systems of social ranking in human societies, with emphasis on the class structure of the United States; power, prestige, and privilege as related to class differences in the United States and other societies; the culture and styles of life of different classes; class and status as determinants of group interests, ideologies, and interaction; and effects of social change and mobility on class structure. Prerequisite: Three hours of sociology or 8 hours of social science. 3 hours.
224. **Sex Stratification in Industrial Societies.** Analysis of social institutions which perpetuate systematic discrimination by sex in industrial societies, with emphasis on occupations. Prerequisite: Sociology 100 or equivalent. 3 hours.
225. **Racial and Cultural Minorities.** A sociological and social-psychological analysis of minority groups; illustrative material drawn from representative racial, ethnic, and status groups. Prerequisite: Sociology 100; junior standing. 3 hours.
229. **Sociology of Religion.** Same as Religious Studies 229. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; and adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.
231. **Analysis of Juvenile Delinquency.** Conceptions of delinquency and its causations; the juvenile court movement; juvenile detention; treatment of juvenile offenders; and delinquency prevention programs. Prerequisite: Sociology 100. 3 hours.
240. **Collective Behavior.** The study of spontaneous, emergent, or transitory actions by large numbers of people not linked through formal organization and not necessarily by common group identity: the phenomena of crowds, mobs, panics, disasters, rumors, booms, fads and fashions, audiences, masses, publics, propaganda targets, and social movements; implications of this behavior from the standpoints of personal problems and social change. Prerequisite: Sociology 100. 3 hours.
246. **Vertebrate Social Organization.** Same as Anthropology, Psychology, and Zoology 246. Introduction to the biosociology of the vertebrates; emphasis on the behavioral, physiological, and population aspects of vertebrate social organizations, from fishes to primates. Prerequisite: One year of introductory biology. 3 hours.
251. **Social Aspects of Mass Communications.** Same as Communications 251 and Journalism 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours.
259. **Organizations and Society.** Survey of major types of complex organizations from the perspective of theories of organization and bureaucratization; emphasizes reciprocal relations between social structure and organizations, particularly business enterprises, unions, schools, public bureaucracies, hospitals, and prisons. Prerequisite: Three hours of sociology or six hours of social science. 3 hours.
260. **Work and Occupations.** Survey of trends in occupations, including specialization, bureaucratization, unions, and professionalization; emphasizes the relation of the Ameri-

- can work system to social stratification and mobility, and to educational and family systems; and includes occupational choice, socialization, and reward systems. Prerequisite: Three hours of sociology or six hours of social science. 3 hours.
270. **Population and Human Ecology.** Same as Rural Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories of human ecology; and current problems. Prerequisite: Sociology 100; junior standing. 3 hours.
 275. **Sociology and the Community.** Nature, structure, and functions of the community; types of communities and examples of some better community studies; and the relation of the community to the larger social organizations. Prerequisite: Sociology 100. 3 hours.
 276. **Sociology of the City.** Study of urban structure and ecology, particularly in light of the planning movement; urban populations; and growth and development of urban communities. Prerequisite: Sociology 100; junior standing. 3 hours.
 277. **Rural Social Change.** Same as Rural Sociology 277. Social forces retarding or accelerating change (traditions, beliefs, attitudes, innovations, social movements, and social planning) as related to rural social organizations and institutions. Field trip to be arranged; for costs see *Timetable*. Prerequisite: Sociology 100. 3 hours.
 290. **Individual Study.** Individual study or research project. Prerequisite: Six hours of sociology; written consent of instructor on form available in 350 Lincoln Hall. 1 to 6 hours. May be repeated.
 291. **Honors Individual Study.** Prerequisite: Open only to seniors in the sociology field of concentration who are eligible for departmental distinction; written consent of instructor on form available in 350 Lincoln Hall. 3 hours.
 296. **Special Topics.** Prerequisite: Sociology 100 and consent of instructor. 3 hours. May be repeated as topics vary.
 300. **Twentieth-Century Sociological Theory.** Attempts to give some idea of four theoretical approaches: symbolic interactionism, structural-functional theory, conflict theory, and the reductionism of George Homans; treatment at varying length of important theorists including Marx (the only one from the nineteenth century), Weber, Durkheim, Simmel, Mead, and Cooley; and includes Parsons, Merton, and Dahrendorf. Prerequisite: Sociology 100. 3 hours or 1 unit.
 301. **Sociological Theory Construction.** Critical tools used to evaluate and construct sociological theories; philosophical issues in theory construction; includes the origins of concepts, the logic of confirmation, and a critical survey of contemporary schools of sociological theorizing. Prerequisite: Sociology 100. 3 hours or 1 unit.
 302. **Classical Social Theory, I.** Analysis of major classical social theorists of the nineteenth and early twentieth centuries, stressing the social and historical foundations of social theory; emphasizes the positivist tradition, including such theorists as Saint-Simon, Tocqueville, Comte, Spencer, Pareto, Durkheim, Sumner, Ward, and Freud. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
 303. **Classical Social Theory, II.** Analysis of major social theorists of the nineteenth and twentieth centuries, stressing the social and historical foundations of social theory; emphasizes the idealist and pragmatist tradition, including such theorists as Marx, Weber, Mannheim, Simmel, Lukacs, the Scottish Moralists, Cooley, Mead, and Veblen. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
 309. **South Asian Social Organization.** An analysis of traditional and emergent features of social organization in South Asia; analyses of family, caste, and village organization; political, economic, and religious change; urbanization; industrialization; and demography. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
 310. **Sociology of Knowledge.** Analysis of major empirical and conceptual developments in the study of the social determination of knowledge; includes the contributions of selected writers and of modern sociological schools, such as symbolic interactionism, structural functionalism, ethnomethodology, phenomenology, and neo-Marxism. Pre-

requisite: Sociology 100 and one 300-level course in sociological theory (300-303), or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

311. **Sociology of Science.** Examination of science as a social and cultural institution; includes similarities and differences between scientific modes of thinking and those governing other human activities. Prerequisite: Sociology 100. 3 hours or 1 unit.
315. **Sociology of Education.** Same as Educational Policy Studies 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on the present education in countries which share Western civilization. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
316. **Sociology of Adolescence.** Adolescence in modern societies; social class, ethnic and minority group membership, and other variables as reflected in adolescent behavior; the problems of adolescence (discontinuities in social development, search for identity, intergenerational conflict, academic and social failure, and juvenile delinquency); the socializing institutions of family, education, peer culture, politics, religion, welfare, social control, the work world, and recreation and leisure; and emphasis on research. Prerequisite: Sociology 100; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
317. **Sociology of Law.** A general treatment of the social origins and consequences of law and legal process; special emphasis on problems of legal change and on the structure and functioning of legal sanctions; and some attention to law and law-like phenomena in other societies including primitive societies, but major focus on American society. Prerequisite: Sociology 100. 3 hours, or $\frac{1}{2}$ or 1 unit.
318. **Industry and Society.** Same as Labor and Industrial Relations 318. Introduction to the social analysis of economic institutions; selected problems of industrialization and technological change; the labor force; occupations and professions; the meanings of work; the factory as a social system; corporate organization and the corporate society; and the changing bases of managerial authority. Prerequisite: Sociology 100, or 6 hours of social science, or consent of instructor; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
320. **Social Roles.** Contemporary role theory and related concepts such as social status and social interaction; age, sex, vocational, social class, and other role types; applications of this theory to the study of the socialization process and personal adjustment; and the analysis of critical group situations and social change. Prerequisite: Sociology 100; junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
321. **Family and Kinship.** An analysis of family and kinship, with major concentration on the American family; investigation of implications of the American kinship system for trends in courtship and mate selection, interaction among kin, and other areas of family life. Prerequisite: Sociology 100, or 8 hours of social science, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
322. **Formal Organizations.** Comparative, structural analysis of formal organizations, emphasizing relations among structural properties of organizations and their consequences for innovation, change, and organizational performance; stresses interaction among theory, methods, and data. Prerequisite: Sociology 259 or six hours of social science. 3 hours or 1 unit.
323. **The Small Social Group.** Theory, observation, and analysis of face-to-face social groups, such as friendships, cliques, clubs, committees, and laboratory and experimental groups; characteristics, functions, and forms of interaction of small groups; and recent theoretical and empirical developments in this field of sociology. Prerequisite: Sociology 201 or Psychology 201. 3 hours, or $\frac{1}{2}$ or 1 unit.
324. **Penology.** Probation, parole, and methods of institutional treatment. Prerequisite: Sociology 331. 3 hours, or $\frac{1}{2}$ or 1 unit.
325. **The Philosophy of Social Science.** Same as Anthropology 329 and Philosophy 329. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit.
326. **Social Mobility and Class Structure.** An advanced course in social stratification, concerned with patterns, causes, and consequences of social mobility and immobility; the

- analysis of rising and falling classes in industrial and developing countries and the circulation of political, social, and economic elites as well as institutional sources of individual mobility. Prerequisite: Sociology 223 or consent of instructor. 3 hours, or ½ or 1 unit.
327. **Japanese Society.** Same as Asian Studies 303. The institutions of contemporary Japan and their historical roots; the Japanese approach to modernization and development and social change; and implications of the Japanese experience for applied social change in developing areas and for social science theory and methodology. Prerequisite: Sociology 100 or consent of instructor. 3 hours or 1 unit.
328. **Sociology of Asian Religions.** Same as Religious Studies 328. A comparative study of the influences of religion on the societies of Asia, and vice-versa; focus on the problems of social change and development; and concentration on the religions and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Sociology 229 or consent of instructor. 3 hours, or ½ or 1 unit.
329. **Comparative Family Institutions.** Cross-cultural analysis of family institutions, with special reference to vital and demographic backgrounds; stress on property, authority, and the handling of deviance, and relationship to religion, economy, and polity. 3 hours, or ½ or 1 unit.
330. **Comparative Political Sociology.** Discussion of basic sociological theories of politics; emphasis on the analysis of forces that keep societies functioning and those that disrupt them and produce political and social change; discussion of social institutions and social movements; and consideration of the relationship between economic development and changes in other aspects of society. Prerequisite: Nine hours of social science or consent of instructor. 3 hours or 1 unit.
331. **Criminology.** Nature and extent of crime; past and present theories of crime causation; criminal behavior in American society and its relation to personal and cultural conditions. Prerequisite: Sociology 100; junior standing; prelegal juniors may be admitted with consent of instructor. 3 hours, or ½ or 1 unit.
332. **Research Methods in Social Psychology: Laboratory Methods.** Same as Psychology 332. Lectures and laboratory in the methods and techniques of social psychological research in laboratory settings. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185. 4 hours, or ½ or 1 unit.
335. **Comparative Social Stratification.** Role of social stratification, nature of social class, class determinants of culture, and class dynamics in comparative perspective; case studies of the United States, slave society, European and Japanese feudalism, Russia, India, China, and a nonliterate society. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or ½ or 1 unit.
336. **Sociology of Marxism.** Critical examination of the Marxist tradition of social analysis, focusing on adaptations of Marx's theories to changing circumstances; Marxist perspectives on social stratification, ideology, alienation, social change, and revolution; and uses of Marxist sociology for protest and legitimization in capitalist and socialist societies. Prerequisite: Nine hours of social science or consent of instructor. 3 hours, or ½ or 1 unit.
340. **Social Movements.** Analysis of the factors in the formation and dynamics of social movements as collective behavior; patterns of growth, types of leaders, and control mechanisms. Prerequisite: Sociology 100. 3 hours, or ½ or 1 unit.
343. **Social Change in Developing Areas.** Same as Rural Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies; special attention given to problems of traditional social structure undergoing modernization; and social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, family, and religion. Prerequisite: Sociology 100 or equivalent. 3 hours, or ½ or 1 unit.
345. **Family Planning and Population Policy.** Same as Health Education and Social Work 345. Background information for professionals involved in the field of family planning; includes historical and current trends in developing and developed nations, with em-

- phasis on the United States; and examines family planning and population policies, and programs and contraceptive methods as related to service delivery and to professional roles. Prerequisite: Consent of instructor. 3 hours or 1 unit.
350. **Soviet Social Institutions.** Analysis of the major social institutions of Soviet society; special attention to the structural consequences of Communist ideology, totalitarianism, and industrialism, and to comparison with and implications for American society; the major areas covered include population data and their sociological implications; history, values, and ideology; political institutions; economic institutions; social stratification and mobility; the nationalities; the family and education; communications and public opinion; and socialized medicine. Prerequisite: Sociology 100 or consent of instructor. Students enrolled in Russian language and area studies as majors or minors are admitted without prerequisite or special permission. 3 hours, or $\frac{1}{2}$ or 1 unit.
352. **Attitude Theory and Change.** Same as Communications 352 and Psychology 352. Comprehensive analysis of theories of attitude acquisition, organization, and change; emphasis on attitude change through communication and effects of persuasive communication on public opinion. Prerequisite: Sociology 201 or Psychology 201, or a comparable course of introduction to social psychology. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Chinese Society.** Systematic treatment of China's social, cultural, and demographic heritage and of the impact of the West on an ancient civilization; the processes of planned and unplanned change in Chinese society; and topics including peasant-land economy, the family, patterns of social stratification and social mobility, the persistence of traditional forms, and the adoption and adaptation of new patterns. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
359. **The Social Psychology of Organization.** Same as Psychology 359. Analysis of the interrelationships between social and psychological factors, and organizational structure and process; emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Sociology 322 or Psychology 355. 3 hours or 1 unit.
360. **Sociology of the Professions.** Examination of the nature, position, functions, and growing importance of the major professions in the contemporary industrial (or industrializing) society; attention to the relationship between the social system and the various professional "communities," recruitment, professional socialization, and bureaucratic versus independent practice. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
364. **Population Trends and Patterns.** Introduction to contemporary demographic patterns and their historical development; transition theory and other models of demographic change; components of population growth and distribution; and trends and differentials in mortality and fertility. Prerequisite: Consent of instructor. 3 hours or 1 unit.
371. **Comparative Social Institutions.** Examination, in a comparative perspective, of some of the major institutional complexes of social systems, such as family and kinship structures, occupations, political institutions, and social stratification and mobility; illustrative materials drawn from a variety of societies, including primitive, nonliterate societies and advanced industrial societies such as the United States, Germany, and the Soviet Union. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
373. **Latin American Social Organization and Institutions.** Analysis of contemporary institutional and social class structures in Latin American communities and societies, and their relationship to certain religious and family patterns; the influence of past and present trends in urbanization, ecological organization, and population growth upon Latin American social systems and institutional organization. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
383. **Mathematical Social Science, I: Algebraic Foundations.** Application of algebraic systems to sociological and social science theory; includes topics in logic, set theory, and theory of algebraic systems necessary for the construction of graph-theoretic and algebraic models of social networks and social systems. Prerequisite: Six hours of sociology,

- political science, or anthropology; Mathematics 124 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 384. Mathematical Social Science, II: Analytical Foundations.** Application of mathematical analysis and calculus to sociological and social science theory, with emphasis on cross-sectional applications; includes topics in derivatives, integrals, and partial derivatives necessary for the explication of foundations of measurement, general systems theory, functional, exchange, and optimizing systems, models of social stratification, structure of organizations, and social interaction and influence. Prerequisite: Sociology 383 or consent of instructor; Mathematics 134 or equivalent. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 385. Social Statistics, I.** Deals intensively with descriptive statistics, probability, statistical inference, and significance testing by means of both parametric and nonparametric tests, and the various measures of association. Prerequisite: Sociology 185, or Mathematics 120, or consent of instructor. 3 hours or 1 unit.
- 386. Methods of Field Research.** Instruction, training, and supervised practice in methods of field research as a basic tool of sociology; emphasis on the role of the field researcher as participant, observer, and interviewer in various kinds of research settings, and on approaches to and applications of field data. Each student develops and executes a field research project dealing with some aspect of institutional, occupational, or general community activity and structure. Prerequisite: Sociology 184 and 185. 3 hours, or $\frac{1}{2}$ or 1 unit.
- 387. Social Statistics, II.** Treats analysis of variance, analysis of covariance, multiple and partial correlations, and complicated sampling procedures. A semester problem is developed which emphasizes integration and application of various statistical techniques to sociological problems. Prerequisite: Sociology 385. 3 hours, or $\frac{3}{4}$ or 1 unit.
- 388. Basic Methods of Demographic Analysis.** Introduction to statistical and mathematical procedures in population analysis; the gathering, processing, and evaluating of registration and census data; the life table model; and procedures of mortality and fertility analysis and population projections. Prerequisite: Mathematics 111 or 112, or equivalent. 3 hours or 1 unit.
- 396. Special Topics.** Prerequisite: Sociology 100 and consent of instructor. 3 hours or 1 unit. May be repeated as topics vary.
- 400. General Sociology.** Systematic sociology, with emphasis on the development and problems of modern structural-functional theory; analysis of the works of major contributors to functionalism, e.g., Durkheim, Weber, Merton, and Parsons; and an examination of the ways in which their work converges to form a cumulative body of sociological theory. 1 unit.
- 402. Social Stratification.** Theory and data concerning structured social inequality in industrialized societies, with special focus on the United States. 1 unit.
- 405. European Sociology: Recent Developments.** Analyses of recent developments and original contributions of European sociology; a review of the major sociological centers in France, Germany, Great Britain, Poland, Russia, and Scandinavia; and an emphasis on special problems selected on the basis of their theoretical importance. Prerequisite: Sociology 300. 1 unit.
- 407. Techniques in Demographic Analysis.** Same as Rural Sociology 407. The analysis of family formation and dissolution; measures of population movement and distribution; and introduction to the stable population model and to applications in the estimation of demographic measures. Prerequisite: Sociology 388. 1 unit.
- 408. The Sociology of Human Fertility.** Comparative studies of levels of fertility in different societies and in the same societies at different times; analysis of sociological, psychological, and demographic factors affecting human reproduction and family planning, and consequences of differentials in fertility. Prerequisite: Graduate standing or consent of instructor. 1 unit.
- 409. Psychological Scaling.** Same as Psychology 409. Scaling theory and methodology, with emphasis upon measurement in psychophysics, differential psychology, and social psychology. Prerequisite: Psychology 307. 1 unit. Offered in 1974-75 and alternate years.

410. **Crowd Behavior.** An examination of classic and contemporary theory and research bearing on crowd formation, form, relocation, and dispersal; the production, maintenance, and alteration of various behaviors within crowds; and emphasis on direct observation of, and the design of field and laboratory research bearing on these phenomena. Prerequisite: Sociology 386. 1 unit.
411. **Sociology of Science.** Social factors in the origin of broad theoretical orientations in science, such as the mechanistic doctrine, vitalism, historicism, atomism, holism, relativism, and indeterminism; social effects of these orientations; the social origin of scientists; ethos of science; the relationship of science to culture change; and the variety and nature of scientific institutions. Prerequisite: Sociology 311 or consent of instructor. 1 unit.
412. **Demography of Human Mortality.** Historical trends and patterns in human mortality and their social implications; international differentials in mortality levels and cause-of-death patterns; the measurement of mortality; age, sex, ethnic, marital, and socioeconomic mortality patterns; and some consequences of mortality declines. Prerequisite: Sociology 270 or 364, and Sociology 388. 1 unit.
414. **Seminar on Social Interaction.** Same as Communications 414. An analysis of social interaction based on the social psychology of C. H. Cooley, G. H. Mead, and W. I. Thomas; presentation of problems of theory, concepts, and method. Prerequisite: One unit of graduate credit in sociology. 1 unit.
415. **Survey Research Methods, I.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course is devoted mainly to planning of the project. Sociology 416, which is devoted to execution of the research project, must be taken in the following semester. For credit, both semesters must be taken in sequence. Three to ten hours of laboratory time per week. 1 unit.
416. **Survey Research Methods, II.** A laboratory course in survey research methods to provide students with intensive training in design, implementation, and data analysis. Students and staff design and carry out a sample survey, with specific topic varying from year to year. This portion of the course sequence will be devoted mainly to execution of the research project. For credit this course must be taken in the semester following Sociology 415. Three to ten hours of laboratory time per week. 1 unit.
417. **Seminar in the Sociology of Law.** Review and analysis of selected areas of theory and research in the sociology of law; focus varies from year to year; topics covered in different years include such areas as civil litigation and the civil courts, police operations and the sociology of law and order, sociological theories of justice, and the operations of legal agencies. Students should consult the instructor about the area to be covered in a particular semester. Prerequisite: Sociology 317. 1 unit.
418. **Seminar in Industrial and Economic Sociology.** Same as Labor and Industrial Relations 418. Discussion and individual research on such topics as industrialization; labor-management relations as group relations; the interrelations of industry and community; technology and the structure of controls in industry; and the problem of a social economics. Prerequisite: Sociology 318 or Labor and Industrial Relations 318, or consent of instructor. 1 unit.
421. **Seminar on Research in Marriage and Family Life.** Analysis of relationships between research methodology and conceptual schemes employed to study family life; critical examination of typical studies which illustrate alternatives in the conceptualization of family interaction and the nature of the family unit. Prerequisite: Consent of instructor. 1 unit.
422. **Theory of Social Groups.** A comparative survey of selected conceptual systems currently used for the analysis of human groups; systems are examined with a view to determining the origins and referents of the concepts, their interrelations, and their utility as sources of testable generalizations relevant to the solution of empirical problems in group analysis. 1 unit.

- 424. Sociology of Human Service Delivery Systems.** Intensive analysis of service delivery systems; focuses on delivery of health-care, educational, mental health, welfare, rehabilitation, and/or correctional services; and includes structure, access, quality, innovation, and modelling of the systems. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
- 425. Racial and Cultural Minorities.** Study of the factual and conceptual aspects of minority status as determined by racial and cultural criteria. Prerequisite: Undergraduate major or minor in sociology or anthropology. 1 unit.
- 429. Seminar in the Sociology of Religion.** Detailed examination of research in the sociology of religion; the substantive character of religious groups and institutions as revealed by this research; significance of the research in the light of sociological theory and of other fields of sociological concern; and the value of the current research methodology. Prerequisite: Sociology 400. 1 unit.
- 432. Special Problems in Theory and Research on Deviant Behavior.** A seminar concerned with the critique of recent theory and research on selected problems in the study of delinquency, crime, mental disorder, and the collaborative development of new theory and research designs. Prerequisite: Sociology 331 or consent of instructor. 1 unit.
- 433. Sociometrics, I.** Advanced application of statistical methods to sociology and sociological models, with emphasis on cross-sectional applications; includes theory of probability and statistical inference, the construction of stochastic sociological models, the general linear single-equation model (regression analysis, analysis of variance, covariance analysis, discriminant analysis), the covariance-structure multinormal model, and linear and log-linear models for discrete data. Prerequisite: Sociology 383 and 384, six hours of calculus and three hours of linear or matrix algebra, or consent of instructor. 1 unit.
- 434. Sociometrics, II.** Continuation of Sociology 433. Extensions of the general linear single-equation model, the covariance-structure multinormal model, and the log-linear model for discrete data to models of several relations in sociology; specification, identification, parameter estimation, and hypothesis testing for simultaneous-equation (recursive and nonrecursive) sociological models; incorporation of measurement error in sociological data; and specification and aggregation analysis. Prerequisite: Sociology 433 or consent of instructor. 1 unit.
- 440. Political Sociology.** An analysis of the impact of social cleavages and cohesion on the operation of political institutions and movements; the place of conflict and power in sociological theory; composition and behavior of power elites; participation in political associations; national and local power structure; social functions of electoral behavior; and modern national and mass political movements. Prerequisite: A course in sociological theory or consent of instructor. 1 unit.
- 444. Seminar in Public Opinion.** Same as Communications 444. Development and theory of public opinion process in society; censorship, interest groups, and propaganda; and mass media and public opinion. 1 unit.
- 449. The Sociology of Sport.** Same as Physical Education 449. Sociological analysis of sport with emphasis on sociological theory; sport and games in cross-cultural analysis; sport's structure and function in modern industrialized society; the system of sport in regard to its role structure, formal organization, and professionalization; its differentiation along social class, age, and sex; and sport contest and conflict. Prerequisite: Nine hours of sociology or anthropology including a course in research methods, or consent of instructor. 1 unit.
- 450. Problems of Soviet Society in Transition.** This seminar examines certain major problems inherent in directed social change from an agricultural to an industrial system under a totalitarian regime of the Soviet type; attention focused on such areas as the different phases of the revolutionary process, inconsistencies between ideological premises and the demands of industrialism, the unanticipated consequences of social change, the simultaneous impact upon the social system of industrialism and totalitarianism, and

implications of the Soviet experience for other countries. Prerequisite: Consent of instructor. 1 unit.

456. **Organizational Sciences, I.** Same as Business Administration 410, Political Science 460, and Psychology 453. An introduction to the principal theories and important empirical research in various disciplines that study organizations. In addition to examination of the subject matter content of various disciplines, students critically examine the capacities and limitations of the various fields to make contributions to the study of organizations. Prerequisite: Enrollment as a major in organizational sciences in a cooperating program, or consent of instructor. 1 unit.
459. **Topics in Work and Organizational Analysis.** Intensive analysis of recent developments in the study of work, occupations, and complex organizations; emphasizes methodological problems of research in the area. Prerequisite: Sociology 322 and consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
474. **Survey Methods in Marketing Research.** Same as Business Administration 431. An analysis of survey methods in marketing with emphasis on sample design, data collection, and data processing; an advanced course in the methods required to design, implement, and evaluate a research project. Prerequisite: Sociology 185 or Economics 171, or equivalent. 1 unit.
475. **Seminar in Demography.** In-depth analysis of a selected area in population studies; topics include population theory, population policy, urbanization, migration, the labor force, ethnic demography, demography of the family, mathematical demography, historical demography, and regional studies. See *Timetable* for current topics. Prerequisite: Sociology 270 or 364, Sociology 388, and consent of instructor. 1 unit. May be repeated to a maximum of 2 units.
476. **Urban Communities and Urbanization.** Intensive study of special aspects of the urbanization process as it affects the life of communities in this and in other countries. 1 unit.
477. **Seminar on Community Organization.** Same as Rural Sociology 477. Theories relating to the community concept and the analysis of community organization; the process of community change as applied to societies in various parts of the world. Prerequisite: Sociology 275 or consent of instructor. 1 unit.
480. **Sociological Theory and Method.** Concerned with the strategy and tactics involved in the construction of specific substantive theories; considers such problems as concept formation, the use and development of models, criteria of good theory, and the role of theory in the development of sociological research. 1 unit.
482. **Recent Developments in Sociology.** Intensive study of selected topics based on contemporary works of major importance in the development of sociological theory. 1 unit. May be repeated for a total of 2 units.
484. **The Sociological Theory of Talcott Parsons.** Systematic description of the social system and comparison with the personality and cultural subsystems within the general action system; examination of the theory of structural change in social system. Prerequisite: Sociology 300 or 400. 1 unit.
485. **The Sampling of Human Populations and Social Organizations.** Same as Business Administration 435 and Psychology 485. Covers procedures for selecting samples from and estimating population parameters for human populations and social organizations; types of sample designs treated include simple random samples, and stratified and cluster samples together with random number and systematic selection techniques; and emphasis on the study of various kinds of advanced sample designs for both area and institutional settings together with the problems involved in the application of analytical statistics to complicated sampling procedures. Each student is required to participate in a field project which involves the actual selection of a cluster sample from the local area. Prerequisite: Sociology 387 or consent of instructor. 1 unit.
487. **Special Problems in Rural Sociology.** Same as Rural Sociology 487. Prerequisite: One unit of graduate credit in sociology; consent of instructor. $\frac{1}{2}$ or 1 unit.
490. **Individual Topics in Sociology.** Supervised individual investigation or study of a topic not covered by regular courses; topic selected by the student and the proposed plan of

study must be approved by the adviser and the staff member who supervises the work. $\frac{1}{2}$ to 2 units.

492. **Seminar on Models for Directed Change.** Same as Social Work 492. Construction and analysis of models for planned intervention at the personal, small group, and community levels; construction of models as interpretations of behavioral science theory; extrapolation of hypotheses and of guides to intervention from the models; and reading from several disciplines as relevant. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 1 unit.
494. **Multivariate Analysis in Psychology and Education.** Same as Educational Psychology 494 and Psychology 494. The principal methods of descriptive statistics used in the analysis of multiple measurements, with emphasis on conventional procedures of factor analysis; profile similarity models; discriminatory analysis; and multidimensional scaling. Prerequisite: Psychology 307 or Educational Psychology 496; consent of instructor. 1 unit.
499. **Thesis Research.** 0 to 4 units.

SPANISH

(See Spanish, Italian, and Portuguese under Humanities, School of)

SPECIAL EDUCATION

Chairperson of Department: Professor M. S. Lilly

Department Office: 188 Education Building, Urbana

117. **Exceptional Children.** Introduction to the study of children who deviate from the average in mental, physical, and social characteristics, including a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. Prerequisite: Sophomore standing and/or Psychology 100. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
314. **Laboratory in Measurement of Exceptional Children.** Practice in administering, scoring, interpreting, and communicating the results of educational tests which may appropriately be given to exceptional children by classroom teachers; practicum sections offered by areas of exceptionality: mental retardation, learning disabilities, gifted, deaf, emotionally disturbed, and culturally disadvantaged. Prerequisite: Credit or concurrent registration in Special Education 324; consent of instructor. 2 hours or $\frac{1}{2}$ unit. May be repeated to a maximum of 4 hours or 1 unit.
316. **The Gifted Child in School and Society.** A consideration of the gifted in society; who they are, their physical, psychological, social, and educational characteristics, and society's needs and provisions for them. The major portion of the course is devoted to the consideration and evaluation of instructional and administrative adjustments that should be made for the gifted in the educational structure. Prerequisite: Educational Psychology 211 or 236; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

318. **Workshop and Laboratory in Education of Exceptional Children.** For those specializing in exceptional children the following sections may be offered: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; and (g) the culturally disadvantaged. Prerequisite: Consent of instructor. 4 to 8 hours, or 1 to 2 units.
321. **Education of Disturbed and Conduct-Problem Children.** Study of the social, emotional, and learning characteristics of children who are disturbed or who exhibit problems of conduct; methods of diagnosis and differentiation; and educational environments and teaching methods used for their remediation. Prerequisite: Special Education 117 or equivalent; Educational Psychology 236 or equivalent; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
322. **Psychology and Education of the Mentally Handicapped, I.** Study of the social, emotional, physical, and learning characteristics and problems of mentally handicapped children; identification and diagnosis; available services and provisions; and educational programs and curriculum of the school. Prerequisite: Consent of instructor. 3 hours or $\frac{1}{2}$ unit.
323. **Psychology and Education of the Mentally Handicapped, II.** Techniques, methods, and materials for teaching mentally handicapped children; principles underlying course of study, parent counseling, and use of records. Prerequisite: Senior standing in special education; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
324. **Mental and Educational Measurement of Exceptional Children.** Theoretical and practical considerations in psychological and educational evaluation of exceptional children; emphasis on understanding the technical and practical aspects of current testing procedures and their application to the education of exceptional children. Prerequisite: Special Education 117; consent of instructor. 3 hours or $\frac{1}{2}$ unit.
416. **Problems in Mental Deficiency.** An advanced course in mental deficiency, covering definitions, theories, classifications, etiology, diagnosis, and social, medical, psychological, and educational rehabilitation procedures; emphasis on the contributions of biology, sociology, anthropology, and psychology to educational theory and practice with reference to the mentally deficient. Prerequisite: Special Education 322 or consent of instructor. 1 unit.
417. **Psychoeducational Problems of Exceptional Children.** A course for educators, students in the behavioral sciences, and students beginning graduate study in special education; study of relevant research dealing with the physical, mental, emotional, and social traits of all types of exceptional children, and consideration of major current problems in the development of educational programs. Prerequisite: Sixteen hours of psychology and/or education, or consent of instructor. 1 unit.
420. **The Social Psychology of the Handicapped.** Study of the social and emotional adjustment of handicapped children and adults, and of the somatopsychological significance of mental, sensory, and motor variations in the adjustive process; evaluation of effects of limitations imposed by the attitude of society, the attitude of the individual toward the handicap, and the handicap itself; and analysis of implications for current educational programs for the handicapped. Prerequisite: Special Education 117 or 417; Educational Psychology 312; or consent of instructor. 1 unit.
421. **Administration and Supervision of Special Education.** Designed for advanced graduate students preparing for administrative or supervisory positions in special education programs; examination of administrative and supervisory practices in educating exceptional children with emphasis on special education programs in the public schools; and application of administrative theory to special education programs. Field trips to observe and evaluate programs are required. Prerequisite: Special Education 417; Administration, Higher, and Continuing Education 450; consent of instructor. 1 unit.
424. **Supervised Practice in Special Education.** Supervised practice in one or more settings in which either mildly or severely impaired students are served; practicum settings may include day, residential, special, and regular schools which serve handicapped students.

- Prerequisite: Admission to the graduate program in special education; consent of supervising faculty member. 1 unit.
425. **Principles and Practices of Resource Teaching.** The principles of resource teaching and their application; includes a review of the historical development of resource teaching and the study of pertinent research; and practical applications in school settings. Prerequisite: Special Education 318 or consent of instructor. 1 unit.
 449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the dean of the College of Education.
 456. **Problems and Trends in Special Education.** Introduction to significant problems, points of view, and trends in the field concerned; exploration of significant research related to organization, content, and techniques in the field in question. Students are encouraged to make special studies in approved areas. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; and (g) culturally disadvantaged children. Prerequisite: Consent of instructor. 1 to 2 units.
 459. **Workshop in Curriculum Development.** Curriculum development projects in specialized fields of special education. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; (g) culturally disadvantaged children; and (h) preschool children. 1 to 2 units.
 490. **Seminar for Advanced Students of Education.** Seminar in the education of exceptional children; open only to persons who have been admitted for doctoral study. Sections may be offered in the following fields: (a) mental retardation; (b) learning disabilities; (c) gifted children; (d) deaf children; (e) emotionally disturbed children; (f) programmed learning for exceptional children; (g) culturally disadvantaged children; (h) administration; (i) behavior modification; and (j) special education. 1 to 2 units.
 491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; students present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze all presentations critically. Limited to students who have been admitted for doctoral study. 1 to 2 units.
 499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

SPEECH AND HEARING SCIENCE

Head of Department: Professor J. J. O'Neill

Department Office: Room 300, 505 East Green Street, Champaign

105. **Voice and Articulation.** Same as Speech Communication 105. Basic factors of voice and speech sound production; analysis of faults that result in minor speech deviations or inadequacies; and individual analysis and guided practice toward improvement of speech habits. 2 hours.
109. **Introduction to Physiological Phonetics.** Basic analysis of the physiological process of producing the sounds of American English; practice in identification and in transcrip-

tion of normal and deviant speech especially for speech clinicians, hearing therapists, teachers of speech, and teachers of the deaf. 3 hours.

175. **A Survey of Historical and Professional Aspects of Speech Pathology and Audiology.** Survey of the fields of speech pathology and audiology; emphasis on historical and philosophical developments, relations to other professions, professional practice, and function and role in study of human communication. Prerequisite: Sophomore standing. 2 hours.
198. **Freshman Seminar.** A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings; open to undergraduates at any level. Requests for activation of this course may be made by students or by faculty and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours. May be repeated.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
208. **Speech and Hearing Problems in the Classroom.** An orientation of prospective teachers to speech and hearing problems encountered in the elementary and secondary schools; emphasis on description of problems and types of classroom management. Prerequisite: Junior standing. 3 hours.
290. **Individual Study.** Individual investigation of special problems. Prerequisite: Ten hours of speech and hearing science, and written approval by the faculty members who will supervise the student's work. 2 hours. May be repeated to a maximum of 6 hours.
291. **Honors Course.** Individual study leading either to a thesis or to departmental honors. Prerequisite: Senior standing; a grade point of 4.0 or consent of the head of the department. 2 hours. May be repeated to a maximum of 4 hours.
301. **General Phonetics.** Same as Speech Communication 301. Basic principles of phonetic study; includes observation and representation of pronunciation, ear training, and practice in transcription. Prerequisite: Junior standing. 3 hours, or $\frac{1}{2}$ or 1 unit.
302. **Manual Communication, I.** Study of methods of manual communication with hearing impaired individuals; analysis of the language of signs and finger spelling in relation to origins, development, and structure; and extensive practice in manual communication. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.
303. **Manual Communication, II.** Continuation of Speech and Hearing Science 302; an in-depth study of manual methods of communicating with hearing impaired individuals; particular emphasis on development of fluency in communicating with language-deficient deaf children and adults; and extensive practice in idiomatic language of signs. Prerequisite: Speech and Hearing Science 302 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.
317. **Psychosocial Educational Aspects of Deafness.** Historical and current societal perceptions of the deaf; an analysis of the various effects and patterns of auditory impairment on children and adults; intelligence, personal and social adjustment, and the psychological processes and how they affect the acquisition of language, speech, speech reading, reading, and writing. Prerequisite: Special Education 117 and either Psychology 100 or Educational Psychology 211, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
319. **Special Education of the Deaf, I.** Survey of the curriculum and techniques in preschools, kindergarten, primary, and intermediate levels as applied to the hard of hearing, deafened, and deaf child; study of sense training, lip reading, vocabulary development, reading techniques, elementary school subjects, language and speech development, auditory training, and curriculum construction. Prerequisite: Consent of instructor. 5 hours, or 1 to 1 $\frac{1}{2}$ units.
320. **Special Education of the Deaf, II.** Continuation of Speech and Hearing Science 319. Prerequisite: Speech and Hearing Science 319. 5 hours, or 1 to 2 units.
348. **Speech and Language Clinical Methods in the Schools.** Same as Elementary and Early Childhood Education 348. Study of methods and materials used in the schools by

- the speech and language clinician. Prerequisite: Speech and Hearing Science 388. 3 hours or ½ unit.
375. **Speech Science, I.** Same as Speech Communication 375 and Linguistics 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, and to fundamental acoustics of speech. Prerequisite: Speech and Hearing Science 109 or 301, or consent of instructor. 4 hours or 1 unit.
 376. **Speech Science, II.** Same as Speech Communication 376 and Linguistics 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and of speech sounds, and the hearing of speech. Prerequisite: Speech and Hearing Science 375. 4 hours or 1 unit.
 378. **Hearing Science.** Acoustics, anatomy, and physiology of the auditory system; psychophysical methods; and a consideration of auditory theories and mechanics. Prerequisite: Speech and Hearing Science 375. 3 hours or ½ unit.
 380. **Communication Disorders in Children: Habilitation and Rehabilitation.** Principles of differential diagnosis, therapeutic diagnosis, clinical and classroom habilitation, and rehabilitation of children with communicative disorders etiologically associated with neurological impairment, emotional disturbance, environmental deprivation, bilingualism, and mental retardation. Prerequisite: Speech and Hearing Science 383; senior or graduate standing; or consent of instructor. 3 hours, or ½ or 1 unit.
 382. **Seminar in Development and Measurement of Spoken Language.** A review of the research and practical methodology associated with the development and measurement of spoken language. Prerequisite: Speech and Hearing Science 383 or consent of instructor. 3 hours or 1 unit.
 383. **Development of Spoken Language.** Same as Speech Communication 383. Study of the correlates of language development from the prelinguistic period to adulthood. Prerequisite: Senior standing; consent of instructor. 3 hours or ½ or 1 unit.
 385. **Speech Pathology, I.** Study of the causes, symptoms, and treatment of speech disorders, including articulatory, vocal, and rhythmical disorders; observation of clinical techniques required. Prerequisite: Ten hours of speech including Speech and Hearing Science 301 and 375, or consent of instructor. 3 hours or ½ unit.
 386. **Basic Therapeutic Principles.** Discussion and demonstration of clinical approaches used with speech and language disorders. Prerequisite: Speech and Hearing Science 385; credit or registration in Speech and Hearing Science 388. 3 hours or ½ unit.
 387. **Practicum in Speech Diagnosis and Therapy.** Observation, practice, and research in diagnosis and therapy of speech disorders. Prerequisite: Speech and Hearing Science 386 and 389; grade point average of at least 3.5; consent of instructor. Students may repeat either Speech and Hearing Science 387 or 398, but not both, for 3 hours. 3 hours or ½ unit.
 388. **Speech Pathology, II.** Study of causes, symptoms, and treatment of speech disorders; includes stuttering, cerebral palsy, aphasia, and cleft palate. Prerequisite: Speech and Hearing Science 385. 3 hours, or ½ or 1 unit.
 389. **Appraisal in Speech Pathology.** Introduction to principles of diagnostic testing; discussion of administration, scoring, and interpretation of tests obtained during speech and language evaluation. Prerequisite: Speech and Hearing Science 383 and 385, or consent of instructor. 3 hours or ½ unit.
 390. **Introduction to Hearing Disorders.** Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; and principles of retraining the hard-of-hearing. Prerequisite: Speech and Hearing Science 375 or consent of instructor. 3 hours or ½ unit.
 391. **Audiometry.** Principles and application of basic audiometry. Prerequisite: Speech and Hearing Science 390 or consent of instructor. 3 hours, or ½ or 1 unit.
 392. **Diagnosis of Hearing Impairments in Infants and Young Children.** Symptoms and causes of hearing impairment in young children; practice in procedures used for the measurement of residual hearing; and the selection and use of hearing aids. Prerequisite:

- site: Speech and Hearing Science 390 and 391, or consent of instructor. 3 hours, or ½ or 1 unit.
393. **Aural Rehabilitation.** Principles and methods of clinical and classroom retraining of the hard-of-hearing; includes lip reading, auditory training, speech disorders and conversation, and counseling. Required in curriculum of teacher training in speech and hearing science. Prerequisite: Speech and Hearing Science 390; grade point average of at least 3.5; consent of instructor. 3 hours, or ½ or 1 unit.
394. **Hearing Conservation.** Survey of auditory screening methods, educational and protective measures, and follow-up procedures utilized in public health, public school and college, and military and industrial settings. Prerequisite: Speech and Hearing Science 390 and 391. 3 hours, or ½ or 1 unit.
398. **Practicum in Audiology.** Observation, practice, and research in diagnosis and rehabilitation of auditory disorders. Students may repeat either Speech and Hearing Science 387 or 398, but not both, for 3 hours. Prerequisite: Speech and Hearing Science 389 and 393. 3 hours or ½ unit.
399. **Design and Analysis of Experiments in Speech and Hearing Science.** An introduction to experimental designs and methods of statistical analysis in speech and hearing research. Prerequisite: Graduate standing or consent of instructor. 3 hours, or ½ or 1 unit.
418. **Communicative Problems of the Deaf.** An advanced course in the problems and procedures involved in the acquisition of language and communication by persons with severe hearing impairment, particularly those with profound prelingual deafness; emphasis on research and measurement in the development of speech, speech reading, residual hearing, reading, written language, and manual communication, including finger spelling and the language of signs; and stress on the applications of recent approaches in linguistics and psycholinguistics to language development. Prerequisite: Consent of instructor. 1 unit.
475. **Experimental Phonetics, I.** Same as Linguistics 475. Theoretical consideration of speech as motor behavior; special reference to physiological investigations of normal respiration, phonation, and articulation; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
476. **Experimental Phonetics, II.** Same as Linguistics 476. Theoretical consideration of speech as an acoustical phenomenon; special reference to acoustical investigations of voice and speech sounds; and survey of the experimental literature. Prerequisite: Consent of instructor. 1 unit.
477. **Measurement of Speech, I.** Same as Linguistics 477. Principles and methods of measuring speech action; special action recorders and transducers; techniques of analysis; problems of experimental design; and laboratory experimentation. Prerequisite: Consent of instructor; credit or concurrent registration in Speech and Hearing Science 475. 1 unit.
478. **Measurement of Speech, II.** Same as Linguistics 478. Principles and methods of measuring the acoustical phenomena of speech; oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design; and laboratory experimentation. Prerequisite: Credit or concurrent registration in Speech and Hearing Science 476; consent of instructor. 1 unit.
481. **Seminar in Neuropathologies of Speech and Language.** Advanced study of speech, vocal, and linguistics problems associated with cerebral palsy and aphasia; topics offered in rotation, one or two each semester, include neurological aspects, aphasia, and cerebral palsy. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 3 units.
482. **Seminar in Stuttering.** Principles, theories, and methods of clinical management of stuttering behavior in children and adults. Prerequisite: Speech and Hearing Science 388. 1 unit.
483. **Psychology of Speech and Hearing Disorders, I.** Same as Psychology 483. Survey of psychological techniques utilized in the clinical and experimental study of speech and

hearing disorders, with special reference to speech disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.

- 484. Psychology of Speech and Hearing Disorders, II.** Same as Psychology 484. Survey of psychological techniques utilized in the clinical and experimental study of speech and hearing disorders, with special reference to hearing disorders; review of research findings and development of experimental designs. Prerequisite: Consent of instructor. 1 unit.
- 486. Advanced Clinical Techniques in Speech and Hearing.** Semi-independent management of complex cases; participation in examination and analysis; topics offered each semester include theory of clinical practice, speech pathology, audiology, language disorders, and field study. Prerequisite: Consent of instructor. $\frac{1}{2}$ to 4 units.
- 488. Diagnostic Procedures in Pathologies of Speech and Language.** Study of diagnostic procedures used in the analysis of neuropathologies of speech and language, and orofacial and laryngeal pathologies of speech. Prerequisite: Consent of instructor. 1 unit.
- 489. Seminar in Orofacial and Laryngeal Pathologies of Speech.** Advanced study of speech and vocal problems associated with cleft palate, laryngeal dysfunctions, and facial-maxillary disturbances; topics offered in rotation, one each semester, include cleft palate and organic vocal problems. Prerequisite: Consent of instructor. 1 unit. May be repeated for a maximum of 2 units.
- 490. Medical Aspects of Speech Disorders and Audiology.** Study of acute and chronic hearing and speech disorders traceable to disease of the ear and vocal mechanisms in relation to the techniques and philosophies utilized in a medically oriented environment. Prerequisite: Speech and Hearing Science 385, 388, and 486. Offered in 1974-75 and in alternate years. 1 unit.
- 491. Seminar in Hearing Disorders.** Principles and methods of clinical management of all types of hearing disorders; survey of current literature and research. The following topics are offered in rotation, one or two each semester: automatic audiometry, aural rehabilitation, and hearing aids and amplification. Prerequisite: Speech and Hearing Science 390. 1 unit. May be repeated for a maximum of 3 units.
- 492. Advanced Audiology.** Advanced study of rationale and development of principles associated with special techniques, procedures, and methods used in audiology. 1 unit.
- 495. Special Problems.** Investigation of speech projects not included in theses. Prerequisite: Consent of head of the department. $\frac{1}{2}$ to 2 units.
- 496. Proseminar in Speech and Hearing Science.** Required seminar for all graduate students; involves reporting of ongoing research of faculty, visiting researchers, and students. 0 units.
- 499. Thesis Research.** Individual research in the various areas of speech and hearing science. 0 to 4 units (summer session, 0 to 2 units).

SPEECH COMMUNICATION

(See Humanities, School of)

SWAHILI

(See Linguistics under Humanities, School of)

THEATRE

Chairperson of Department: Professor B. Hobgood

Department Office: 4-122 Krannert Center for the Performing Arts

100. **Practicum, I.** Laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting, sound properties, costumes, and makeup for public performance. Prerequisite: Consent of instructor for nontheatre majors. 1 to 3 hours. May be repeated for three semesters.
101. **Theatre: Modern Forms.** Introduction to theatre aesthetics, to theatre as a profession, and to the theatre plant; study of dramatic form and structure with emphasis on realism, naturalism, and their modifications; and a survey of theatre history from 1850 to World War II. 4 hours.
102. **Theatre: Contemporary Forms.** Study of revolts against realism; includes symbolism and its theatre, theories of Appia and Craig, expressionist drama and its staging, Brecht and epic theatre, theatre of the absurd and later developments, and the musical play. Prerequisite: Theatre 101. 3 hours.
103. **Theatre: Classical and Medieval Forms.** Theatre architecture, drama, and play production practices of ancient Greece and Rome, of Asia, and of Britain and the continent during the Middle Ages. Prerequisite: Theatre 101. 3 hours.
104. **Theatre: Sixteenth- and Seventeenth-Century Forms.** Survey of theatre history and drama with emphasis on Baroque Spain, Elizabethan England, and Renaissance Italy. Prerequisite: Theatre 101. 3 hours.
105. **Theatre: Seventeenth- and Eighteenth-Century Forms.** Survey of theatre history and drama with emphasis on France of the neoclassical era, England of the Restoration, and Europe and America of the Georgian period. Prerequisite: Theatre 101. 3 hours.
111. **Materials and Processes: Textiles.** Study of fibers, weaving methods, and color application; laboratory projects used to demonstrate textiles' response to cutting, draping, and suitability for stage scenery, properties, and costumes. 2 hours.
112. **Materials and Processes: Woods and Metals.** Study of the properties, availability, and costs of the woods and metals most useful for the theatre; laboratory experience in cutting, jointing, shaping, and finishing. 2 hours.
113. **Materials and Processes: Papers and Plastics.** Exploration of the potential use for a broad range of papers and plastics in the construction of stage properties, decoration, and accessories. 2 hours.
120. **Elements of Stagecraft.** Same as Speech Communication 157. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting; and lectures, readings, and practical problems. Not open to theatre majors. 4 hours.
121. **Scenecraft.** Introduction to theatre shop organization, tools, and materials; basic scenery construction, painting, and assembling. Open to students in the College of Fine and Applied Arts only. 2 hours.
131. **Stage Lighting and Sound Effects.** The history and development of stage lighting; the theory and function of stage lighting and sound; examination of instruments, equipment, and installations; and planning the design of stage lighting and sound. Lectures, practical problems, and laboratory. 3 hours.
140. **Costume Construction.** Theory and practical techniques of sewing, fitting, and decorating stage costumes analyzed and applied to specific production situations; laboratory practice culminating in construction of a period costume by each student. 2 hours.
141. **Makeup for the Theatre, I.** Principles, materials, equipment, and application techniques; corrective and age effects; and delineation of character through use of paint and hair goods. Lecture, discussion, and practice. 2 hours.
142. **Makeup for the Theatre, II.** Equipment and methods for creation of three-dimensional effects through use of putty, wax, adhesives, and rubber; techniques of design and execution of masks, national types, and nonrealistic styles. Lecture, demonstration, and practice. Prerequisite: Theatre 141. 2 hours.

170. **Fundamentals of Acting.** Same as Speech Communication 161. Study of the methods of acting, with emphasis given to the basic stage techniques; the role of the character in relation to the play as a whole; and the intellectual and emotional values of the play and their interpretations by means of voice and action. 3 hours.
171. **Speech for the Stage: Fundamentals.** Study of the physical and psychological bases of speech and the analysis and synthesis of speech sounds; training in the requirements of good voice in the theatre; projection through breath control, support of tone, resonance, voice placement, articulation, and the element of tone; and exercises in elimination of speech regionalisms. 2 hours.
172. **Speech for the Stage: Dialogue.** Examination of the dialogue in modern plays, primarily British and American; analysis of its construction, characteristics, thought, and emotion; making meaning clear through phrasing; and attainment of vitality and variety. Class practice and performance. Prerequisite: Theatre 171. 2 hours.
173. **Speech for the Stage: Dialects.** Analysis of British stage speech and the important departures from it and of the major dialects in the United States; their phonetic transcription; training in perception; and the use of dialects in plays. Exercises and practice. Prerequisite: Theatre 172. 2 hours.
174. **Movement for the Stage: Improvisation.** Purposes and history; exercises in developing the sense memories and in their pantomimic recall; exercises to heighten the actor's observations, imagination, and creative powers; and characterized pantomime, both improvised and based on characters in plays. 2 hours.
175. **Movement for the Stage: Techniques.** Uses of movement in acting; physiological and psychological bases of movement; analysis and synthesis of the body's movement; movement timing, spacing, force, quality, climax, and motivation; stage conventions in movement; and movement and character. Exercises and drill. Prerequisite: Theatre 174. 2 hours.
176. **Acting: Characterization.** The psychology of acting; methods of preparing a role. Prerequisite: Theatre 175. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
220. **Advanced Scenecraft.** The examination of stage equipment, including rigging systems, revolves and wagon systems, platforming, and methods of shifting stage scenery. Prerequisite: Theatre 121. 2 hours.
221. **Advanced Scenery Painting.** Studio course in the problems of painting stage scenery, with special emphasis on contemporary materials and rendering processes. Prerequisite: Theatre 220 or consent of instructor. 2 hours.
222. **Scene Design, I.** Introduction to the basic processes of designing for the stage, including physical considerations, relevant research for design, stage perspective, and specific design projects for proscenium and open stage forms. Prerequisites: Theatre 220 or consent of instructor. 3 hours.
231. **Stage Lighting Design.** A studio course analyzing current lighting practices by means of production-oriented projects. Prerequisite: Theatre 131. 3 hours.
243. **Approaches to Stage Costume.** Theoretical and practical aspects of theatrical costuming for the actor and director. Prerequisite: Home Economics 285 or consent of instructor. 3 hours.
263. **Theatre of the Black Experience.** An aesthetic approach to the study of Afro-American drama concerned with the principles, playwrights, movements, and media of black drama since 1960. Prerequisite: Consent of instructor. 3 hours.
271. **Acting: Studio, I.** Periodic performances of soliloquies and short scenes from plays written after World War I; presentation before members of the theatre faculty and invited guests. Prerequisite: Second-semester junior standing in the acting option or consent of the theatre faculty. 3 hours.
272. **Acting: Styles for Period Plays.** Acting in important theatrical periods: classical Greece, the *commedia dell'arte* of Italy, Elizabethan England, the Carolinian Restoration, seventeenth-century France, and nineteenth-century Europe and America; the effect

on acting of the theatre's physical aspects; and class performance of scenes. Prerequisite: Theatre 170 or 176. 3 hours.

280. **Fundamentals of Dramatic Writing and Structure.** Same as Rhetoric 263, Speech Communication 263, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works; and a term project consisting of a play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.
281. **Directing, I.** Same as Speech Communication 255. Problems of script selection and interpretation, casting, rehearsing, and performances; techniques of composition, movement, and business for the proscenium stage; and direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.
291. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
292. **Individual Topics.** Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.
300. **Practicum, II.** Advanced laboratory in acting, directing, playwriting, and theatre management; the design, construction, and handling of scenery, lighting sound, properties, costumes, and makeup for public performance. Prerequisite: For nontheatre majors, consent of instructor. 1 to 3 hours, or $\frac{1}{4}$ to $\frac{1}{2}$ unit. May be repeated to a total of 12 hours or 2 units.
310. **Theatre Planning and Programming.** Theatre programming including consideration of relationships of audience to stage, the merits of the various stage technological systems, and the related business, audience, and production facilities of a theatre center. 2 hours or $\frac{1}{2}$ unit.
320. **Scene Design, II.** Studio course with design projects for period plays, the musical theatre, and contemporary forms. Prerequisite: Theatre 222 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.
330. **Photo-Projection Techniques.** Integration of film techniques with the scenic environment for modern staging, including initial rendering, film processing, projection surfaces, and stage projection equipment. Prerequisite: Theatre 131. 2 hours or $\frac{1}{2}$ unit.
341. **Costume Design.** Theories, problems, and projects in theatrical costume. Prerequisite: Theatre 140 and Home Economics 285. 3 hours or 1 unit.
353. **Creative Dramatics for Children.** Study of the subject matter and techniques of creative dramatics for children with laboratory application. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
354. **Theatre for the Child Audience.** Study of the history, objectives, and techniques of play production for the child audience; laboratory application. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.
355. **Musical Theatre.** Same as Music 355. Study of musical theatre and its scores and librettos; consideration of production problems, including those of choreography, scenery, and costume design; and the planning and production of a musical play or score. Prerequisite: Junior standing and consent of instructor. 3 hours or $\frac{1}{2}$ unit.
371. **Acting: Studio, II.** Public presentation of short scenes under semiproduction conditions: basic lighting, stock costumes, and minimal properties. Prerequisite: Second semester senior standing in the acting option, or consent of theatre faculty. 3 hours or $\frac{1}{2}$ unit.
380. **Advanced Dramatic Writing.** Same as Radio and Television 363 and Speech Communication 363. Application of principles of dramatic form and structure to the more complex problems of playwriting; practice in writing in sustained dramatic forms. Prerequisite: Theatre 280; consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a total of 6 hours or 2 units.
381. **Directing, II.** Production problems and techniques of movement and business for non-proscenium staging areas; direction of appropriate scenes for class presentation; and

study of production practices for the musical play. Prerequisite: Theatre 281. 3 hours or ½ unit.

401. **Studies in Dramatic Form and Structure.** Same as Speech Communication 400. Studies in the relationship of dramatic form and structure to the contemporary production of historical and modern plays. Prerequisite: Theatre 361 and 362, or equivalent; consent of instructor. 1 unit.
402. **Studies in Theatre History: Beginnings to the Seventeenth Century.** Examination of movements and contributors to the theatre. A minimum of four of the following divisions are emphasized each time the course is offered: origins; ancient Greece; Rome; Middle Ages; Italian Renaissance; England, 1558-1642; Spain, 1500-1700; and France, 1548-1700. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units with consent of instructor.
403. **Studies in Theatre History: Seventeenth Century to 1900.** Examination of movements and contributors to the theatre. A minimum of three of the following divisions are emphasized each time the course is offered: England, 1642-1790; colonial America; Italy, France, and Spain in the eighteenth century; northern and eastern Europe in the eighteenth century; Europe and America in the early nineteenth century; and Europe and America in the late nineteenth century. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units with consent of instructor.
404. **Studies in Theatre History: Twentieth Century.** Examination of movements and contributors to the theatre. A minimum of three of the following divisions are emphasized each time the course is offered: Europe, 1875-1915; Orient; Europe and America between the wars; 1945-1960; and since 1960. Prerequisite: Consent of instructor. 1 unit. May be repeated to a maximum of 2 units with consent of instructor.
405. **Seminar in the Stage History of Classic English Plays.** Same as English and Speech Communication 469. Analysis and reconstruction of past productions of classic plays, with special reference to Shakespeare. Prerequisite: One year of work in dramatic literature or theatre history; consent of instructor. 1 unit.
406. **Seminar in Theatre History.** Same as Speech Communication 468. Studies in the history of the theatre. Prerequisite: Consent of instructor. 1 unit.
407. **Seminar in Theatre Art.** Same as Speech Communication 465. Studies in the aesthetics of the theatre. Prerequisite: Consent of instructor. 1 unit.
411. **Colloquium in Advanced Design and Theatre Technology.** Projects in design for the theatre or in theatre technology, including stage scenery, costuming, lighting, makeup, projections, and sound and stage systems. Prerequisite: Candidacy for M.F.A. in theatre with design and technology specialty, or consent of instructor. 2 units. May be repeated to a maximum of 6 units.
412. **Studio in Theatre Production, I: Concepts and Their Exploration.** Open to students from the several specialties in theatre who are combined into ensembles to investigate and develop methods for analysis, visualization, and primary rehearsals. Prerequisite: Candidacy for M.F.A. in theatre, or consent of instructor. 2 units. May be repeated to a maximum of 4 units.
413. **Studio in Theatre Production, II: Rehearsal and Performance.** Open to students from the several specialties in theatre who are combined into ensembles in order to produce one or more theatrical productions. Prerequisite: Candidacy for M.F.A. in theatre, or consent of instructor. 2 units. May be repeated to a maximum of 4 units.
455. **Studies in Theatre Organization, Management, and Operation.** A study of the organization, management, and operation of the theatre staff, with special emphasis on the business procedures involved in theatre management and promotion. 1 unit (summer session, 1 unit).
471. **Colloquium in Acting.** Performance assignments in productions prepared at Krannert Center, combined with individual evaluation by the acting staff; special acting workshops dealing with problems relevant to the semester's production schedule. Prerequisite: Candidacy for M.F.A. in theatre with acting specialty, or consent of instructor. 2 units. May be repeated to a maximum of 6 units.

481. **Colloquium in Directing.** Individual assignments in directing, stage managing, or coaching of actors carried out in conjunction with the semester's productions; prepared at Krannert Center or in conjunction with the training of actors in the undergraduate curriculum. Prerequisite: Candidacy for M.F.A. in theatre with directing specialty, or consent of instructor. 2 units. May be repeated to a maximum of 6 units.
491. **Special Problems.** Individual research in selected topics by arrangement with the instructor. $\frac{1}{2}$ to 2 units.
495. **Creative Project.** Open to M.F.A. candidates in theatre only. 2 units.
499. **Thesis Research.** 0 to 2 units.

THEORETICAL AND APPLIED MECHANICS

Head of Department: Professor R. T. Shield

Department Office: 212 Talbot Laboratory, Urbana

150. **Analytical Mechanics (Statics).** Resultants of force systems; algebraic and graphical conditions of equilibrium of force systems; analysis of forces acting on members of trusses, frames, etc.; forces due to friction; and centroids. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 2 hours.
152. **Engineering Mechanics, I (Statics).** Analysis of force systems by means of vector algebra; treatment of two- and three-dimensional systems, including force fields; and introduction of the principle of virtual work. Prerequisite: Physics 106; concurrent registration in Mathematics 140, 141, or 145. 3 hours.
154. **Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 212 with less emphasis on some topics. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 4 hours.
156. **Analytical Mechanics (Statics and Dynamics).** A combination of Theoretical and Applied Mechanics 150 and 212. Prerequisite: Physics 101 or 106; concurrent registration in Mathematics 140, 141, or 145. 5 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
212. **Engineering Mechanics, II (Dynamics).** Introduces the elements of vector calculus as applied to mechanics; treats the kinematics of three-dimensional motion of a particle and of a rigid body; considers motion relative to translating and rotating reference frames; and treats the kinetics of particles and rigid bodies by using principles involving force, mass, and acceleration, work and energy, and impulse and momentum. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
221. **Elementary Mechanics of Deformable Bodies.** Elastic and inelastic relationships between external forces (loads) acting on deformable bodies and the stresses and deformations produced; tension and compression members; members subjected to torsion and to bending; buckling (columns); combined stresses; repeated loads (fatigue); energy loads and impact; and influence of properties of materials. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 140, 141, or 145. 3 hours.
223. **Mechanical Behavior of Solids.** Influence of loading conditions and environment on the behavior of engineering materials; effects of rate of loading, time, temperature, number of stress cycles, and state of stress on the ductile and brittle behavior of materials; and significance of mechanical properties. Prerequisite: Concurrent registration in Theoretical and Applied Mechanics 221. 1 hour.
224. **Behavior of Materials.** Introduction to atomic and molecular structure of metals, cement, concrete, plastics, ceramics, and glass; response of these materials to rapid, steady, and repeated loads at various temperatures (and environments) in terms of rheological models; and fracture behavior of specific materials, that is, stress rupture,

- brittle fracture, and fatigue of metals and concrete. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.
235. **Fluid Mechanics.** Fluid properties and statics; fluid flow; ideal and real fluids; similitudes; laminar and turbulent flow in closed conduits; boundary layers; free surface flow; and turbo-machinery. Prerequisite: Theoretical and Applied Mechanics 212. 4 hours.
293. **Senior Research Project.** Students work briefly in each of the several areas of modern research in theoretical and applied mechanics. After selecting one area for further study, each student prepares a proposal for a research project which will be carried out in Theoretical and Applied Mechanics 294. Prerequisite: Senior standing in engineering mechanics. 2 hours.
294. **Senior Research Project.** Individual projects conducted in the field of mechanics previously selected in Theoretical and Applied Mechanics 293. Each student prepares a technical report or paper and presents the results orally. The best papers are presented at a symposium held at the end of the semester and are bound together and published as a theoretical and applied mechanics report. Prerequisite: Theoretical and Applied Mechanics 293. 4 hours.
299. **Thesis.** Thesis investigation of special subjects including theoretical and/or experimental research. Prerequisite: Senior standing; approval of head of department. 3 hours.
311. **Mechanical Vibrations.** Kinematics of vibratory motion; comprehensive study of motion having single degree of freedom; critical speeds of shafts; vibration of systems with several degrees of freedom; and applications to engineering problems. Credit is not given for both Theoretical and Applied Mechanics 311 and Civil Engineering 374. Prerequisite: Theoretical and Applied Mechanics 154, 156, or 212, and 221. 3 hours, or $\frac{1}{2}$ to 1 unit.
314. **Advanced Dynamics for Engineers.** Three-dimensional kinematics of a rigid body; general dynamics of a rigid body; moments and products of inertia; kinetic energy; rotation of a rigid body about a fixed axis and about a fixed point; Euler equations of motion; gyroscopic theory; introduction to Lagrange equations; and engineering applications. Prerequisite: Theoretical and Applied Mechanics 212 or equivalent; Mathematics 341 or 345. 3 hours or 1 unit.
321. **Advanced Mechanics of Deformable Bodies.** Basic concepts of mechanics of deformable bodies and brief review of elementary topics; theory of stress and strain at a point; theories of failure, including failure by fracture; unsymmetrical bending; curved beams; torsion of noncircular sections; energy principles; and Castigliano's theorem. Prerequisite: Theoretical and Applied Mechanics 221, and 223 or 224. 3 hours, or $\frac{1}{2}$ to 1 unit.
324. **Flow and Fracture of Structural Metals.** Fundamental concept of strength of crystalline engineering materials at atomic, single crystal, and polycrystalline levels of association in relation to engineering mechanisms of failure; functional relationship between material variables, state of stress, strain, time, temperature, and failure of engineering components by creep, stress rupture fatigue, and brittle fracture. Prerequisite: Theoretical and Applied Mechanics 221 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
326. **Experimental Stress Analysis.** Measurement of stresses or deformations that are of significance in the engineering design of load resisting members; use of optical, electrical, and mechanical instrumentation, models, analogies, brittle coatings, electrical resistance gauges, photoelasticity, etc. Prerequisite: Theoretical and Applied Mechanics 221 or equivalent. 3 hours, or $\frac{1}{2}$ to 1 unit.
334. **Fluid Mechanics and Advanced Hydraulics.** Study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels; viscosimetry; dimensional analysis; effects of boundary conditions; cavitation; water tunnel; hydraulic jump; water hammer pumps; and turbines. Some laboratory work. Prerequisite: Theoretical and Applied Mechanic 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
335. **Dynamics of Fluids.** An intermediate course in the mechanics of fluids introducing analytical methods of solution for ideal and real fluids; potential flow theory, theoretical

- approaches to viscous flows including boundary layer theory, and the analysis of compressible flows are indicated. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or $\frac{3}{4}$ or 1 unit.
346. **Dimensional Analysis and Theory of Models.** The nature and use of dimensions; systematic calculations and dimensionless products; algebraic theory of dimensional analysis; similarity and model laws; and derivation of model laws from differential equations. Applications include von Karman's theory of similarity in turbulent flow, boundary layer theory, topics in open channel flow, model laws for pumps and turbines, topics in structural analysis and vibration theory, and topics in the theory of heat. 3 hours, or $\frac{1}{2}$ or 1 unit.
351. **Fundamental Concepts of Deformable Body Mechanics.** Introduction to the general theories of kinematics of deformable bodies; general balance laws applicable to continuum mechanics; constitutive relations (stress-strain relations); and introductions to linear elasticity, linear viscoelasticity, and special concepts in other areas of solid mechanics and fluids. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343 and 345. 3 hours or 1 unit.
360. **Continuum Mechanics, I.** A unified treatment of modern continuum mechanics; linear algebra and analysis, review of kinematics and general balance laws, and general theory of mechanical constitutive equations (simple materials). Prerequisite: Theoretical and Applied Mechanics 351 or equivalent. 3 hours or 1 unit.
373. **Engineering Acoustics.** Same as Electrical Engineering 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems; vibrating string; vibrating membrane; plane waves; spherical waves; vibrating piston; acoustical filters; loudspeakers and microphones; principle of reciprocity; the ear; and architectural acoustics. Students may not receive credit for both Theoretical and Applied Mechanics 373 and Electrical Engineering 374. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.
381. **Mechanical Behavior and Fracture of Noncrystalline Solid Engineering Materials.** Characterization of noncrystalline materials including inorganic glasses, polymers, clay, cement, asphalt, particulate composites, and fibrous composites according to their molecular or microscopic structure and macroscopic mechanical behavior; examination of models of structure that relate to mechanical behavior; treatment of time-dependent behavior using rheological models; discussion of ductile and brittle modes of fracture; and introduction of concepts of fracture mechanics and the statistical theory of fracture strength used to describe fracture strength. Prerequisite: Theoretical and Applied Mechanics 224 or equivalent; consent of instructor. 3 hours or $\frac{3}{4}$ unit.
392. **Analysis and Synthesis of Problems.** Emphasis on the rational analysis of comprehensive problems and engineering systems. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.
393. **Independent Study.** Individual studies in any area of theoretical and applied mechanics. 1 to 8 hours, or $\frac{1}{4}$ to 2 units.
400. **Seminar in Engineering Mechanics.** Treatment of special topics in the field of mechanics including mechanics of solids problems such as fracture of metals and creep of materials; fluid flow problems such as the nature of turbulence, boundary layer theory, nature and effects of roughness of boundary, and effects of free surface; dynamics problems such as vibration of beams with moving loads and the gyroscope; and certain other topics, such as biomechanics, that cut across all areas of mechanics. Each semester one or more of these topics is selected and announced as the area to be covered. 0 to $\frac{1}{4}$ unit.
412. **Vibration Analysis.** Continuation of Theoretical and Applied Mechanics 311. Specific topics include systems of several degrees of freedom; applications of generalized coordinates and Lagrange's equations; boundary value problems in vibration of elastic bodies, including strings, rods, and beams; Stodola's method; iteration process and matrix procedure; vibrations in reciprocating machines; airplane structures and propellers;

- impact and transient vibrations; self-excited vibration; stability; and nonlinear systems. Prerequisite: Theoretical and Applied Mechanics 311 or equivalent. 1 unit.
416. **Energy Principles in Engineering Mechanics.** Introduction to the variational principles of mechanics and their applications to engineering problems; the derivation, interpretation, and applications of the principle of virtual displacements, the principle of minimum potential energy, and the principle of complementary energy; major emphasis on Castigliano's theorem, Hamilton's principle, and Lagrange's equations of motion; brief treatment of variational methods of approximation; and numerous illustrative applications to stress analysis of statically determinate and statically indeterminate frames, problems of elastic stability, the theories of rings and curved beams, the theory of elastic plates, vibrations of structures, and wave motions. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
417. **Stochastic Structural Dynamics.** Same as Aeronautical and Astronautical Engineering 452. Structural dynamics problems treated from a probabilistic point of view; introduction of theory of probability and random processes as mathematical tools; study of response of structures under random excitation in the order of increasing complexity; and discussion of probability of failure for such structures. Prerequisite: Aeronautical and Astronautical Engineering 255 or Theoretical and Applied Mechanics 314, or equivalent. 1 unit.
418. **Aerodynamic Noise.** Same as Aeronautical and Astronautical Engineering 453. Mathematical techniques for the analysis of intensity, spectrum, and directivity of noise field in various environments; practical examples including jet and rocket engines, propeller and fan, sonic boom, and cabin noise of high-speed vehicles. Prerequisite: Graduate standing in engineering, physics, or mathematics. 1 unit.
424. **Properties of Engineering Materials.** Structure of metals and behavior of materials under various conditions of loading and use, including static, creep, fatigue, and impact; effects of high and low temperature, strain rate, state of stress, and internal structure; criteria of failure; relation of mechanical properties to behavior; significance of mechanical properties; tests and interpretation of test data; and material specifications. $\frac{1}{2}$ or 1 unit.
425. **Mechanics of Inelastic Bodies.** Presents methods of obtaining relations between loads, deformations, stresses, and strains in various members that are stressed beyond the elastic range; most applications consider both time-independent and time-dependent (creep) inelastic deformations; and specific topics include straight and curved beams, columns, and beam-columns, fully plastic analysis of statically indeterminate members and structures, torsion of circular and noncircular bars, and torsion-tension of bars of circular cross section. Prerequisite: Theoretical and Applied Mechanics 321. $\frac{1}{2}$ to 1 unit.
428. **Analysis of Nonlinear Systems.** Same as Electrical Engineering 428. Treatment of singular points and stability considerations; consideration of graphical and analytical methods including the perturbation method, variation of parameters, Galerkin's method, and the Ritz method for solving nonlinear differential equations. Prerequisite: Mathematics 341; consent of instructor. 1 unit.
429. **Theory of Linear and Nonlinear Viscoelasticity.** Same as Aeronautical and Astronautical Engineering 429. Fundamental concepts of viscoelasticity with applications: elastic-viscoelastic analogies, creep and relaxation functions, thermomechanical reciprocity relations, variational principles, model fitting, shear center motion, thick-walled cylinders under pressure and inertia loads with material annihilation, sandwich plates, propagation of viscoelastic waves, vibration of bars, plates and shells, nonlinear elastic-viscoelastic analogy, properties of nonlinear viscoelastic stress-strain laws, creep rupture, and torsion of nonlinear bars and shells. Prerequisite: Aeronautical and Astronautical Engineering 326, or consent of instructor. 1 unit.
431. **Theory of Ideal Fluid Flow.** Together with Theoretical and Applied Mechanics 432, covers topics in advanced fluid mechanics that are the basis of many modern developments. Ideal fluid theory is concerned with an incompressible fluid of negligible viscos-

ity. The differential equations of motions are derived and the several methods of obtaining flow solutions are presented: the obtaining of velocity potentials and stream functions by superposition of the effects of source, doublets, and vortices, and by the methods of conformal mapping. Relations for finding the resultant forces and moments on bodies are derived and applied to bodies such as lifting surfaces. Other topics include the theory and application of free streamline flows, vortex motions, and surface wave theory. Prerequisite: An elementary course in fluid flow; a course in advanced calculus. 1 unit.

432. **Theory of Flow of Viscous Fluids.** Although a logical continuation of Theoretical and Applied Mechanics 431, this course need not be taken sequentially. The theoretical development, analysis, and solution of incompressible viscous fluid flow problems; derivation of the differential equations of motion, starting with the stress relations occurring in viscous fluids; development of direct and approximate solutions for laminar flows; presentation of boundary-layer theory; introduction to the occurrence of turbulence and its characterization; the basic equations for analyzing turbulent flows; presentation of approximate solution for flows in boundary-layers with and without pressure gradients (and separation) pipes and jets; and consideration of experimental observation and application to technological problems. Prerequisite: An elementary course in fluid flow; a course in differential equations. 1 unit.
438. **Turbulence.** Starting with the statistical modes of characterizing turbulence, discussion covers statistical theory, energy considerations, and nature of turbulence in typical flows. Laboratory experiments are used to illustrate hot wire technique of turbulence measurements and the structure of turbulence. Prerequisite: Theoretical and Applied Mechanics 432 or equivalent. 1 unit.
441. **Applied Analysis in Engineering.** Provides training in applications of mathematics to engineering problems; most of the illustrations taken from engineering mechanics. Prerequisite: Mathematics 141; Mathematics 343 and 345 recommended. 1 unit.
442. **Applied Analysis in Engineering.** Continuation of Theoretical and Applied Mechanics 441. Prerequisite: Mathematics 141; Mathematics 343 and 345 recommended. 1 unit.
451. **Theory of Elasticity with Application to Engineering Problems.** Study of the mechanics of elastic deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain, and properties of materials; detailed study of relations between stresses, strains, and displacements; and special consideration given to their significance in engineering problems. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343; Mathematics 341 or equivalent. 1 unit.
452. **Theory of Elasticity with Application to Engineering Problems.** Continuation of Theoretical and Applied Mechanics 451. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
454. **Theory of Shells.** Provides the theoretical basis of stress analysis of shell-type structure, such as ships, submarines, monocoque aircraft structures, concrete roofs and domes, pressure vessels, and containers for liquids; includes the differential geometry of shell theory, equilibrium equations, momentless theory of shells, strains in shells, statically indeterminate problems of shells, energy formulations, and stability of shells. Prerequisite: Theoretical and Applied Mechanics 451. 1 unit.
457. **Classical Elastostatics.** A modern unified treatment of the concepts and techniques developed by investigating the Cauchy-Navier equations; emphasis on the interpretation and motivation of ideas and their interrelation for the solution of three-dimensional problems; and topics including the classical boundary-value problems, existence and uniqueness theorems, stress functions and displacement potentials, singular states of stress, extension of Green's method to the equations of elasticity, method of series, and approximation techniques. The course represents a preparation for (1) students interested in the current state of knowledge in classical elasticity, and (2) students intending to do doctoral dissertations in classical elasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent; consent of instructor. 1 unit.

- 458. Wave Motion in Continuous Media.** Analysis of the dynamics of deformable bodies with a major emphasis on elastic media; introduction to the terminology associated with and the methods of treating such problems; general discussion of the motion of strings, bars, shafts, plates, and other bodies when subjected to load; detailed examination of approximations involved; and discussion of their engineering significance. Prerequisite: Theoretical and Applied Mechanics 311, 314, and 451; Mathematics 341, 342, or 343, or equivalent. 1 unit.
- 460. Continuum Mechanics, II.** Continuation of Theoretical and Applied Mechanics 360. Viscous fluids (without memory) and elastic bodies as examples of simple materials; general principles of continuum thermodynamics; thermodynamics of elastic bodies; and selected topics in modern continuum mechanics. Prerequisite: Theoretical and Applied Mechanics 360. 1 unit.
- 462. Theory of Plasticity.** The physical and mathematical formulation of the mechanics of inelastically deformed bodies, plastic stress-strain laws, and their association with yield and loading function; deals primarily with members subjected to biaxial and triaxial stress conditions. Specific topics include applications to flexure and torsion of prismatic members; expansion of thick-walled cylinders and spherical shells; and introduction to problems in plane plastic flow and variational plasticity. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent. $\frac{1}{2}$ or 1 unit.
- 464. Theory of Buckling.** The pertinent information and theoretical background required for the prediction of failure by buckling of structures such as airplanes, ships, bridge trusses, fabricated towers, and shells; practical illustrations. Specific topics include elastic columns with various end restraints; buckling of framework, arches, rings, and plates; inelastic buckling of columns and plates; lateral buckling of beams; energy theory; Ritz procedure; and Euler's equation of the calculus of variations. Prerequisite: Theoretical and Applied Mechanics 416 and 451. $\frac{1}{2}$ or 1 unit.
- 467. Thermomechanics of Nuclear Reactor Systems.** Same as Nuclear Engineering 467. Origin of thermomechanics problems in nuclear reactor systems; heat generation and transfer in nuclear power systems; thermal stress in nuclear reactor systems; dynamical theory including effects of thermal-shock and thermal stress-wave propagation; and current thermomechanics problems in nuclear reactor design. Term paper required. Prerequisite: Nuclear Engineering 401 or consent of instructor. 1 unit.
- 485. Fracture Mechanics.** Acquaints students with the analytical and experimental techniques used to solve current fracture problems; topics include a discussion of the macroscopic theories used to determine the static strength of bodies containing cracks; linear elastic fracture mechanics (the tool and the model) and its relation to the Griffith criteria of fracture; elastic-plastic fracture mechanics models; small-scale yielding results and their implications; and an introduction to fracture mechanics in the realm of general yielding. Examples of how the analytical methods can be applied are derived from discussion of the general fracture control plan. Prerequisite: Theoretical and Applied Mechanics 324 and 451, or consent of instructor. 1 unit.
- 493. Advanced Independent Study (Special Problems).** Analytical or experimental studies in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, theory of plasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, fatigue of metals, etc. $\frac{1}{2}$ to 2 units.
- 499. Thesis Research.** 0 to 4 units.

UKRAINIAN

(See Slavic Languages and Literatures under Humanities, School of)

URBAN AND REGIONAL PLANNING

Head of Department: Professor M. P. Brooks

Department Office: 909 West Nevada Street, Urbana

171. **Planning of Cities and Regions.** Survey of city and regional planning as related to problems and programs of urbanization and resource development. 3 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
236. **Planning Workshop, I.** Field work dealing with selected physical and/or social planning problems. Prerequisite: Consent of instructor. 6 hours.
240. **Planning Internship.** Professionally supervised field experience in public and private planning or development agencies; designed to introduce students to professional employment and actual planning practice. Students work in a University-approved agency of their own choice either during the summer session between the junior and senior years or part-time during a regular semester. Summary reports are submitted by both employer and student. Prerequisite: Senior standing or consent of instructor. 0 to 6 hours. No more than 8 hours of Urban Planning 240 and 340 may be applied toward the Bachelor of Urban Planning degree.
260. **Special Problems.** Special projects, research, and independent reading. Prerequisite: Consent of head of department. 2 to 6 hours.
271. **Urban Planning Practice.** Principles and techniques of professional planning, types of practice, levels and forms of plans and planning processes, implementation measures, evaluation, and citizen involvement. Prerequisite: Credit or concurrent registration in Urban Planning 171; junior standing in urban and regional planning or consent of instructor. 3 hours. Students may not receive credit for both Urban Planning 271 and 377.
315. **Environmental Change and Public Policy.** Same as Landscape Architecture 315. Introduction to the applicability of social and political theory, methods, and techniques to environmental issues and problems; surveys federal, state, and local conditions related to changing patterns in environmental attitudes and natural resource obligations. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
320. **Planning for Historic Preservation.** Survey of the preservation movement in relation to urban planning; techniques for selection of sites and definition of districts; funding, regulation, and implementation measures; and case studies of preservation plans and programs. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
325. **United States Population and Land Settlement Policy.** Scientific, ethical, constitutional, political, and land use planning aspects of American population policy and issues, including migration and immigration; population distribution and redistribution; and national, regional, and local growth and land use policy. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
337. **Planning Workshop, II.** Small-group field work dealing with actual planning problems at local, regional, state, or national levels; emphasis on problem analysis and generation of alternatives. Student selects from several sections, depending on specific interests. Prerequisite: Consent of instructor. 6 hours or 1 $\frac{1}{2}$ units.
338. **Planning Workshop, III.** Small-group field work dealing with actual planning problems at local, regional, state, or national levels; emphasis on production of concrete plans and policies, including strategies for implementation. Student selects from several

- sections, depending on specific interests. Prerequisite: Consent of instructor. 6 hours or 1 ½ units.
- 340. Advocacy Planning Field Work.** The student is assigned as an observer and participant to work directly with disadvantaged persons or groups, usually through community advocacy agencies, human relations commissions, or comparable mechanisms. The student as advocate planner is responsible to the clients he or she serves, with faculty constituting resource groups. Opportunities may be limited to insure continuity of service; evaluation reports required. Prerequisite: Senior standing or consent of instructor. 0 credit.
- 348. The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, Environmental Studies, General Engineering, Geography, Mechanical Engineering, and Veterinary Medical Science 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or ¼ or ½ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or ¼ unit.
- 351. History of Planning in the United States.** Planning from the mid-nineteenth century to the present as related to cultural, societal, and philosophical influences. Prerequisite: Consent of instructor. 3 hours or ¾ unit.
- 360. Introduction to Social Planning.** Survey of the major social policy issues confronting urban areas in the United States today; examination of problems, policies, and programs in several functional areas (education, manpower development, health, welfare, etc.), as well as their interrelationships and their respective contributions to the problems of poverty; and analysis of processes of citizen participation as well as the roles of government in general and the planner in particular. Prerequisite: Consent of instructor. 3 hours or ¾ unit.
- 374. Urban Planning Theory.** Examination of the urban planning function within a theoretical, methodological, institutional, and professional context. Prerequisite: Consent of instructor. 3 hours or ¾ unit.
- 376. Planning Analysis.** Research and analytic techniques in urban planning: economic base and employment; population; market analysis; and derivation and use of statistical data. Prerequisite: Consent of instructor. 3 hours or ¾ unit.
- 377. Land Use Planning and Policy Formulation.** Principles and techniques for the preparation of land use, transportation, and community facilities plans; delineation of the comprehensive plan and the policy report; and social and economic implications of land use planning. Prerequisite: Urban Planning 171, junior standing in urban and regional planning, or consent of instructor. 3 hours or ¾ unit. Students may not receive credit for both Urban Planning 377 and 271.
- 378. Law and Planning Implementation.** Cases, legislation, and materials illustrative of the social, economic, and environmental interrelationships of land-use planning and the dynamic role of law as a system of controlled conflict; traditional and emerging concepts of zoning, subdivision regulation, housing codes, and review procedures. Prerequisite: Political Science 150 and 151, or 305 and 306, or Urban Planning 379, or consent of instructor. 3 hours or ¾ unit.
- 379. Legal Basis of Governmental Planning.** Cases and materials illustrative of legal concepts and institutions basic to the governmental planning process including property, police power, eminent domain, taxation, separation of powers, and due process; indicates both the problems and potential of adaptability by the legal system in response to contemporary socioenvironmental issues. Prerequisite: Consent of instructor. 3 hours or ¾ unit.
- 380. Survey of Regional Planning.** Concepts and procedures for planning of regions; river

- valley, metropolitan, state, and national planning. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
382. **Managing Urban Development.** Implementation of the planning program through administrative mechanisms, finance, citizen participation, and reorganization; evolution of implementation techniques; status of the local planning agency; and professional approaches to operation and management of the planning agency. Prerequisite: Political Science 150 and 151, or 305 and 306, or senior standing in urban and regional planning. 3 hours or $\frac{3}{4}$ unit.
384. **Urban Design and Planning Methods.** Concepts and techniques of urban analysis, plan making, and implementation essential for effective interdisciplinary work in urban design; case studies of major types of large-scale projects. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
386. **Seminar on Environmental Policy and Law.** Identification and analysis of environmental issues and legal developments primarily at the state and federal levels. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit.
387. **Special Topics in Urban and Regional Planning.** Seminar on topics of current interest, as announced in the *Timetable*. 3 hours or $\frac{3}{4}$ unit. May be repeated to a maximum of 12 hours or 3 units.
393. **Environmental Quality Management.** Same as Environmental Studies 393. Issues and concepts used in determining the desired level of environmental quality, with emphasis on pollution control; comparisons of management alternatives with emphasis on equity, cost, and ease of administration; and includes the study of an actual pollution management problem. Designed for students with an environmental or public policy analysis background. Prerequisite: Senior or graduate standing; calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit.
440. **Professional Internship.** Summer, part-time, or other professional-level employment in the field of planning, usually in an area of concentration; exposure to the social, political, and institutional setting in which planning operates; and full documentation of internship activities required. Prerequisite: Consent of instructor. 0 credit.
441. **Suburban Land Use Patterns.** Same as Landscape Architecture 441. Theoretical basis for land use plan design, including site qualities, offsite environmental impacts, relative location of activities, and sequences of development. $\frac{3}{4}$ unit.
442. **Spatial Design Methods.** Same as Landscape Architecture 442. Representations and solution procedures for problems involving the arrangement of land use activities in space; optimizing, approximate, and graphic methods, their applications, effectiveness, and efficiency; and experiments with computerized procedures. Prerequisite: Landscape Architecture 441 or consent of instructor. 1 unit.
455. **Urban Transportation Policy.** Major policy elements in urban transportation and the relationship of urban transportation to the region, including the decision-making process, configuration and growth of the metropolitan area, and allocation of resources. $\frac{3}{4}$ unit.
463. **Housing and Urban Policy Planning.** The role of housing in social policy planning; methodologies for analyzing the housing market with regard to social planning issues; and demand and supply trends in American housing related to historic and projected social, economic, and physical changes. Prerequisite: Undergraduate course in micro-macro economics or consent of instructor. $\frac{3}{4}$ unit.
464. **Housing and Urban Planning Practice.** Housing location and developmental models; market analysis techniques; appraising and financing methodologies; and analysis of current housing programs and housing research. Prerequisite: Urban Planning 463; a course in statistics; consent of instructor. $\frac{3}{4}$ unit.
471. **Planning Strategies and Models.** Critical overview of current planning and decision-making models, with particular reference to their application to social problem solving in urban areas; interaction between the planning process and urban political systems. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.

473. **Urban Structure and Functions.** The concept of urban structure; the elements of urban spatial structure and growth; the human stresses in urban spatial structure; and structural remedies past and present. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
475. **Planning Methods.** Applied analytic methods in urban and regional planning, including survey research techniques, population analysis and projection, community economic and employment analysis, land-use and transportation studies, and evaluation techniques. Prerequisite: Urban Planning 376 or equivalent; consent of instructor. $\frac{3}{4}$ unit.
476. **Urban and Regional Analysis.** Quantitative analysis of urban and regional growth and development with emphasis on forecasting techniques; population projection by age-cohort survival, matrix methods, and linkages with economic projections; and economic projection by economic base, multiplier models, input-output, and simulation models. Prerequisite: A course in statistics or consent of instructor. $\frac{3}{4}$ unit.
477. **Economic Analysis of Public Plans and Policies.** Techniques of policy analysis and evaluation; includes microeconomic concepts, cost-benefit analysis, cost-effectiveness, and planning-programming-budgeting systems; and examines selected public policies in areas such as transportation, environmental control, health, education, housing, and local finance. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
485. **Issues in State and Local Public Finance.** Selected topics, such as alternative mechanisms for public resource allocation, sources of funds, the impact of growth on local finances, functions by governmental level, and intergovernmental transfers and revenue sharing. Prerequisite: Urban Planning 477, Economics 300, or consent of instructor. $\frac{3}{4}$ unit.
487. **Seminar.** Selected topics in urban and regional planning; several sections each semester. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.
488. **Urban Planning Research.** Independent study in selected urban and regional planning topics. Prerequisite: Consent of instructor and head of the department. $\frac{1}{4}$ to $\frac{3}{4}$ unit. No more than 3 units may be applied toward the Master of Urban Planning degree.
498. **Master's Project.** A major independent or small-group project, conducted in lieu of a master's thesis. Prerequisite: Consent of instructor. 1 $\frac{1}{2}$ unit.
499. **Thesis Research.** Prerequisite: Graduate standing in urban and regional planning; consent of the head of the department. 0 to 1 $\frac{1}{2}$ units.

VETERINARY BIOLOGICAL STRUCTURE

Head of Department: Professor A. R. Twardock

Department Office: 335 Veterinary Medicine Building, Urbana

A proposal is currently under consideration to combine this department with the Department of Veterinary Physiology and Pharmacology to form a Department of Veterinary Anatomy, Physiology, and Pharmacology.

300. **Gross Anatomy.** Same as Veterinary Medical Science 300. Systematic and topographic study and dissection of the dog; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 5 hours.
301. **Histology.** Same as Veterinary Medical Science 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, and skin; special reference to domestic animals. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 4 hours.
302. **Gross Anatomy.** Same as Veterinary Medical Science 302. Comparative study and dissection of the domestic animals with special reference to development and adaptation

to function; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 4 hours.

303. **Microscopic Organology.** Same as Veterinary Medical Science 303. Microscopic study of the organs and systems of different domestic animals; lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
304. **Applied Anatomy.** Structural consideration of domestic and pet animals relative to diagnostic and surgical procedures. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours.
305. **Developmental Anatomy.** Same as Veterinary Medical Science 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals; lectures and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours.
378. **Veterinary Clinical Orientation.** Same as Veterinary Clinical Medicine, Veterinary Pathology and Hygiene, and Veterinary Physiology and Pharmacology 378. Lectures and demonstrations illustrating the interrelationships between the basic sciences and their applications in medicine and surgery; includes methods of restraint and handling of several animal species. Prerequisite: First-year standing in the veterinary curriculum. 1 hour.

VETERINARY CLINICAL MEDICINE

Acting Head of Department: Professor J. W. Judy

Department Office: 244 Small Animal Clinic, Urbana

347. **Veterinary Clinical Oncology.** Same as Veterinary Pathology and Hygiene 347. Current techniques in diagnosis and treatment of neoplastic diseases of domesticated animals, including chemotherapy, immunotherapy, radiotherapy, and surgery; concepts of oncogenesis and tumor immunology; and incidence, breed and site predilections, behavior, prognosis, radiographic and other clinical features and complications of general classes and specific types of neoplasms. Prerequisite: Third-year standing in veterinary medical curriculum. 2 hours.
360. **Medicine, I: General Medicine.** Diagnosis, treatment, and prophylaxis of infectious, noninfectious, and surgical diseases of the small domestic animals; lectures, quizzes, and demonstrations. Required in the veterinary curriculum. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
361. **General Veterinary Surgery.** Surgical principles including hemostasis, shock, fluid, and electrolyte balance; discussion of the surgical procedures of the major systems of the body; the aftercare of the patients, both farm and domestic pet species; and laboratory covering practice and demonstrations of the principles of surgery involved in the major body systems. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.
362. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases; lectures, quizzes, and demonstrations. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
363. **Reproduction, Obstetrics, and Genital Diseases.** Principles of animal reproduction, fertility, and obstetrics of all species of domestic animals, with emphasis on farm animals. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
364. **Medicine, II: General Medicine.** Diagnosis, treatment, and prevention of noninfectious, nutritional, metabolic, toxic, and parasitic diseases of large animals; lecture and discussion. Prerequisite: Third-year standing in veterinary curriculum. 5 hours.

365. **Special Veterinary Surgery.** Lectures and clinical demonstrations on surgical diseases and their diagnosis, operative treatment, and aftercare, together with appropriate laboratory practice. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 5 hours.
366. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
367. **Radiology and Radiobiology.** Same as Veterinary Physiology and Pharmacology 367. General principles of radiology and radiobiology techniques and application to the diagnosis and therapy of animal diseases; lectures and discussions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 3 hours.
368. **Infectious Diseases and Preventive Medicine.** Diagnosis, treatment, and prevention of infectious diseases of large animals; lectures, discussions, and quizzes. Prerequisite: Fourth-year standing in veterinary curriculum. 5 hours.
369. **Clinical and Laboratory Practice.** Clerkship in veterinary clinical medicine and surgery. Prerequisite: Fourth-year standing in veterinary medicine professional curriculum, or equivalent. 4 hours.
370. **Seminar.** Faculty presentation of in-depth material concerning clinical aspects of medicine and surgery. Prerequisite: Fourth-year standing in veterinary medical curriculum. 1 hour.
371. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Fourth-year veterinary students enrolled in this course spend two days at the Dixon Springs Agricultural Center at Simpson, Illinois, where they participate in the fall roundup and gain valuable experience in the handling, examination, and treatment of diseases of range cattle; see *Timetable* for approximate cost. Transportation is furnished. Prerequisite: Fourth-year standing in veterinary medicine. 8 hours.
372. **Veterinary Jurisprudence and Ethics.** Principles of law and professional ethics of importance to members of the veterinary profession; animal diseases and related regulatory laws and their administration; and federal procedure under animal disease, food, and meat inspection laws. Prerequisite: Fourth-year standing in veterinary medical curriculum. 2 hours.
374. **Clinical and Laboratory Practice, III.** Clerkship in veterinary clinical medicine and surgery. Prerequisite: Fourth-year standing in veterinary medicine professional curriculum, or equivalent. 3 hours.
375. **Reproduction, Obstetrics, and Genital Diseases.** Lectures, discussion, and laboratory practice in obstetrics, pregnancy diagnosis, and male and female infertility. Prerequisite: Veterinary Clinical Medicine 363; third-year standing in veterinary curriculum. 2 hours.
376. **Economics and Business Management for the Veterinarian.** Summary of management in a practice of veterinary medicine; emphasis on the application of economic principles of record analysis, personnel management, business organization, and financial management. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
377. **Swine Practice Management, I.** A study of swine production methods and their interaction with disease conditions; lectures, laboratories, and field trips for problem solving. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 2 hours.
378. **Veterinary Clinical Orientation.** Same as Veterinary Biological Structure, Veterinary Pathology and Hygiene, and Veterinary Physiology and Pharmacology 378. Lectures and demonstrations illustrating the interrelationships between the basic sciences and their applications in medicine and surgery; includes methods of restraint and handling of several animal species. Prerequisite: First-year standing in the veterinary curriculum. 1 hour.
379. **Advanced Veterinary Ophthalmology.** Structure and physiology of the eye of domestic animals, alterations caused by ocular diseases, and the pharmacologic effects of drugs

used in ocular therapeutics; basic instruction in the use of microbiologic and cytologic examination, biomicroscopy, gonioscopy, tonography, electroretinography, and ultrasonography. Prerequisite: Veterinary Clinical Medicine 369 or equivalent, or consent of instructor. 2 or 3 hours. Students enrolled for lecture only receive 2 credit hours; students enrolled for lecture and laboratory receive 3 credit hours.

380. **Beef Practice Management.** A study of beef cattle practice with emphasis on herd health, reproduction, and disease control; lectures, laboratories, and field trips. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour.
381. **Clinical and Laboratory Practice, IV.** Selective clerkship in veterinary clinical medicine and surgery. Prerequisite: Fourth-year standing in veterinary medicine professional curriculum, or equivalent. 2 to 4 hours.
382. **Exotic Pets.** Principles of restraint, diagnosis, and medical and surgical treatment of diseases of small exotic mammals, birds, reptiles, and fish kept as pets. Prerequisite: Third-year standing in veterinary medicine curriculum. 1 hour.
383. **Swine Practice Management, II.** Laboratory experiences with practical diagnostic and surgical procedures conducted in modern veterinary swine practice; includes field trips to packing plants and swine production units. Prerequisite: Veterinary Clinical Medicine 377. 1 hour.
384. **Client Relations.** Introduction to client relations, including techniques of effective verbal and nonverbal communication and applications of these techniques for veterinary students. 1 hour.
385. **Advanced Radiographic Interpretation--Large Animal.** An exercise in systematic interpretation of large animal radiographs. Prerequisite: Veterinary Clinical Medicine 371 and consent of instructor. 2 hours.
386. **Advanced Radiographic Interpretation--Small Animal.** An exercise in systematic interpretation of small animal radiographs. Prerequisite: Veterinary Clinical Medicine 371 and consent of instructor. 2 hours.
387. **Advanced Veterinary Anesthesiology.** Lecture material includes anesthetic effects on cardiopulmonary physiology, interrelationships between anesthesia and various types of drug therapy, and balanced anesthetic techniques; laboratory includes new and advanced monitoring techniques, intermittent positive pressure ventilation, and specific anesthetic procedures. Prerequisite: Senior standing in veterinary curriculum or consent of instructor. 1 hour.
388. **Advanced Soft Tissue Surgery.** Advanced techniques in soft tissue surgery in small animals. Prerequisite: Veterinary Clinical Medicine 361 and 365. 1 hour.
389. **Small Animal Diagnostic Instrumentation.** Training in the use of special medical and surgical diagnostic techniques, including endoscopy, ultrasound, and an introduction to electrodiagnostics. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour.
390. **Equine Reproduction.** Instruction in equine reproductive physiology, infectious and noninfectious infertility problems, obstetrical procedures, and preventive medicine practices. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour.
391. **Advanced Orthopedics.** After videotape viewing and discussion of procedures during the lecture period, students perform advanced surgical techniques during the laboratory periods. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour.

VETERINARY MEDICAL SCIENCE

Head of Department: Professor L. M. Jones

Department Office: 141 Veterinary Medicine Building, Urbana

300. **Gross Anatomy.** Same as Veterinary Biological Structure 300. Systematic and topo-

- graphic study and dissection of the dog; lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Five hours of zoology; consent of instructor. 1 unit.
301. **Histology.** Same as Veterinary Biological Structure 301. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, and skin; special reference to domestic animals. Prerequisite: Registration in veterinary curriculum or consent of instructor. 1 unit.
302. **Gross Anatomy.** Same as Veterinary Biological Structure 302. Comparative study and dissection of the domestic animals; special reference to development and adaptation to function; and lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Medical Science 300 and 301; consent of instructor. 1 unit.
303. **Microscopic Organology.** Same as Veterinary Biological Structure 303. Microscopic study of the organs and systems of different domestic animals; lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. $\frac{3}{4}$ unit.
305. **Developmental Anatomy.** Same as Veterinary Biological Structure 305. Development of organs and systems with emphasis on specializations in domestic and laboratory animals; lectures and quizzes. Prerequisite: Veterinary Medical Science 300 and 301, or consent of instructor. $\frac{3}{4}$ unit.
315. **Veterinary Physiology.** Same as Veterinary Physiology and Pharmacology 315. Nervous and muscular systems, respiration, acid-base balance, urine formation, and body fluids and their regulation; lectures, discussions, and laboratory. Prerequisite: Second year standing in veterinary curriculum or consent of instructor. 1 $\frac{1}{4}$ units.
316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Physiology and Pharmacology 316. Blood and lymph, circulation, digestion, metabolism, and endocrine systems; lectures, discussions, and laboratory. Prerequisite: Veterinary Medical Science 315 or consent of instructor. 1 unit.
318. **Pharmacology.** Same as Veterinary Physiology and Pharmacology 318. General principles of pharmacy and an analysis of the action of chemical agents on physiological processes; lectures, discussions, demonstrations, and laboratory. Prerequisite: Credit or concurrent registration in Veterinary Medical Science 315 and 316; consent of instructor. 1 unit.
320. **Pharmacology and Toxicology.** Same as Veterinary Physiology and Pharmacology 320. Principles of drug action and an analysis of action of chemical agents on living organisms; includes intoxications of domestic animals; lectures, discussions, and demonstrations. Prerequisite: Veterinary Medical Science 318 or consent of instructor. 1 unit.
332. **Veterinary Microbiology and Immunology.** Same as Veterinary Pathology and Hygiene 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance and the properties, pathogenesis, and control of viral and fungal infection of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or equivalent; consent of instructor. 1 unit.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Pathology and Hygiene 333. Protozoan and arthropod parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: A total of 20 hours in chemistry or animal biology, or both; consent of instructor. $\frac{3}{4}$ unit.
334. **General Pathology.** Same as Veterinary Pathology and Hygiene 334. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, and inflammation and neoplasia. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: A total of 25 hours in histology, parasitology, physiology, and microbiology; consent of instructor. 1 unit.
335. **Special Pathology.** Same as Veterinary Pathology and Hygiene 335. Disease processes affecting organs and anatomic systems, and those occurring in specific diseases; lectures, quizzes, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 334 or equivalent; consent of instructor. 1 unit.
336. **Helminth Parasites.** Same as Veterinary Pathology and Hygiene 336. Helminth parasites affecting domestic animals and man; lectures, discussions, and laboratory. Pre-

quisite: A total of 20 hours in chemistry or animal biology, or both; consent of instructor. $\frac{3}{4}$ unit.

340. **Introduction to Applied Statistics.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; and techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit.
346. **Management and Diseases of Laboratory Animals.** Same as Veterinary Pathology and Hygiene 346. Principles of management of conventional and gnotobiotic laboratories; emphasis on proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
347. **The Use of Laboratory Animals: Principles and Techniques.** Lectures and discussions dealing with laboratory animals as complex biological instruments and variables affecting their definition; laboratories deal with techniques used in laboratory animal experimentation. Prerequisite: Consent of instructor. $\frac{1}{2}$ unit.
348. **The Air Pollution System.** Same as Agricultural Engineering, Civil Engineering, Environmental Studies, General Engineering, Geography, Mechanical Engineering, and Urban and Regional Planning 348. Synthesis of current concepts on air pollution sources, meteorological dispersion, health effects, economic damage, and the political, legal, planning, and engineering implications for control and enforcement. In Part I, current concepts and applications utilizing recent information are presented. In Part II, implications are examined in small group discussions of several contemporary societal problems. Prerequisite: Senior or graduate standing. 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit. Consent of instructor is required for those students who wish to take this course for 1 hour or $\frac{1}{4}$ unit.
374. **General Epidemiology.** Same as Environmental Studies, Health Education, Medical Sciences, and Veterinary Pathology and Hygiene 374. The epidemiology and natural history of infectious and noninfectious diseases, including integrated vector control and host resistance, and mental health and public health. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent, or consent of instructor. 4 hours or 1 unit.
392. **Special Problems.** Individual research on a special problem chosen in consultation with the instructor and department head. Prerequisite: Registration in veterinary curriculum with grade-point average of 4.0 or above, or consent of instructor. $\frac{1}{2}$ unit. May be repeated for a total of 1 unit.
408. **Principles of Hematology.** The cellular morphology of the blood and bone marrow of animals in health and disease; lectures, discussions, demonstrations, and laboratory. Prerequisite: Veterinary Medical Science 301 or equivalent, or consent of instructor. $\frac{1}{2}$ unit.
413. **Experimental Mammalian Physiology.** Same as Physiology
413. **The Physiological Applications of Experimental Mammalian Surgery.** Prerequisite: Physiology 401 and 402, or equivalent; consent of instructor. 1 unit.
415. **Mechanisms of Microbial Infections.** Newer concepts of host-microorganism relations; emphasis on the dynamics and pathogenic mechanisms of microorganisms, immune responses and defense factors of the host, and pathogenesis of specific infections. Lectures, discussions, laboratory, and special problems. Prerequisite: Microbiology 326 or Veterinary Medical Science 332, or equivalent; consent of instructor. $\frac{3}{4}$ or 1 unit.
416. **Epizootiology.** Principles and problems of epizootiology; special consideration of the zoonoses; ecology of the host and parasite as related to resistance, adaptation, perpetuation, and distribution; the principles and factors in interference, carrier and latent

- states, and reservoirs and control. Prerequisite: Veterinary Pathology and Hygiene 331 or Veterinary Medical Science 332, or equivalent, or consent of instructor. 1 unit.
417. **Medical Mycology.** Study of the fungi that cause infections in man and animals; taxonomy, methodology, epidemiology, pathology, and diagnosis. Prerequisite: Microbiology 326 or Veterinary Medical Science 332, or equivalent. 1 unit.
418. **Concepts and Topics in Immunology.** Same as Biology 418. Newer concepts and theories in the field of immunology, including theories of antibody formation and immunological tolerance, regulation of the immune response, biosynthesis and structure of antibodies, and evolutionary aspects of the immune response. Lectures and discussion. Prerequisite: Consent of instructor; Microbiology 327 and Biology 307 recommended. $\frac{1}{2}$ unit.
419. **Animal Virology.** Same as Microbiology 419. A discussion-laboratory with major emphasis on host-parasite relationships, natural history, and epidemiology, supplemented with appropriate laboratory techniques as they pertain to the major groups of animal viruses. Prerequisite: Microbiology 326 and 327, or Veterinary Pathology and Hygiene 331 and Veterinary Medical Science 332; Biochemistry 350 or 354; consent of instructor. $\frac{3}{4}$ unit.
425. **Experimental Parasitology.** Same as Zoology 425. A broadly based consideration of the relation of parasites to their hosts and to their environments, and of the factors which influence these relationships. Prerequisite: A laboratory course in parasitology or protozoology; organic chemistry; Biochemistry 350 and statistics recommended. 1 unit.
440. **Design and Analysis of Biological Experiments.** Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Horticulture 440. Statistical methods as tools for research; principles of designing experiments and methods of analysis for various kinds of designs, including factorial experiments, considered from the viewpoint of when and how to use them. Prerequisite: Veterinary Medical Science 340 or equivalent. $\frac{3}{4}$ unit.
445. **Advanced Macroscopic Pathology.** Concepts and interpretations of gross pathologic changes, and the integration of host-parasite reactions. Prerequisite: Veterinary Medical Science 334 and 335, or equivalent; consent of instructor. $\frac{1}{2}$ or 1 unit.
450. **Advanced Veterinary Pathology.** Advanced study of gross and microscopic pathology of diseases of domestic animals. Prerequisite: Veterinary Medical Science 335 or equivalent. 1 unit.
455. **Comparative Oncology.** A comparative study of the nature of mammalian and avian neoplasms based on general and special methods of tumor identification, classification, and experimentation; lectures, demonstrations, and laboratory. Required course for students majoring in pathology in Department of Veterinary Medical Science. Prerequisite: Veterinary Medical Science 445 and 459, or equivalent. 1 unit.
457. **Ultrastructural Pathology.** Same as Biology 457. Ultrastructural basis of pathologic processes occurring in animal tissues and cells. Lectures, discussions, and reports. Prerequisite: Zoology 430; consent of instructor. $\frac{3}{4}$ or 1 unit.
459. **Advanced Correlative Pathology.** Discussion and interpretation of disease processes of domestic animals; emphasis on the correlation of gross, microscopic, and clinicopathologic findings with alterations of function. Prerequisite: Veterinary Medical Science 308, 335, 445 or 450, or equivalent; consent of instructor. 0 to 1 $\frac{1}{2}$ units.
460. **Advanced Veterinary Physiology.** Advanced study of physiology, nutrition, and biochemistry as related to problems in veterinary medical science; problems include white muscle disease, sweet clover disease, ketosis, hypoglycemia, and digestive disturbances; and laboratory includes planning, executing, and reporting a specific course project. Prerequisite: Veterinary Medical Science 315 or 316, or equivalent; consent of instructor. $\frac{1}{2}$ unit.
461. **Advanced Veterinary Pharmacology.** Evaluation of drugs, pharmacological aspects of biological antagonisms, chemotherapy, antibiotics, chelating agents and chemical biological correlation. Prerequisite: Consent of instructor. $\frac{3}{4}$ unit.

463. **Radioisotopes in Biological Research: Principles and Practice.** Same as Animal Science 463 and Biophysics 463. Lectures, demonstrations, and laboratory on the fundamentals of radioisotope procedures and applications in biology and medicine. Prerequisite: Quantitative chemistry; one year each of mathematics, physics, and biology, and/or consent of instructor. 1 unit.
465. **Comparative Pharmacodynamics.** The comparative study of drug effects and the handling of drugs by various organisms; emphasis on mode of action of elements and chemical compounds; and factors influencing absorption, distribution, metabolism, and excretion of drugs. Prerequisite: Three courses in biology; four courses in chemistry including biochemistry; consent of instructor. $\frac{3}{4}$ unit.
466. **Comparative Environmental Toxicology and Drug Resistance.** The chemistry, mechanisms, actions, and disposition of substances toxic to man and other animals; nature of host-toxicant interactions; and the biological consequences of such interactions, including toxicological mechanisms and their public health significance. Prerequisite: Veterinary Medical Science 465 or consent of instructor. $\frac{3}{4}$ unit.
490. **Seminar.** Required of all graduate students whose major is veterinary medical science. $\frac{1}{4}$ unit.
491. **The Experimental Method in Veterinary Research.** Planning of experiments, use of controls, interpretation of results, sources of error, and writing the research report. $\frac{1}{2}$ unit.
492. **Special Problems.** Basic and applied study including orientation and research on pertinent initial and continuing problems in the student's area of interest. Prerequisite: Consent of instructor. $\frac{1}{4}$ to 1 unit.
499. **Thesis Research.** 0 to 4 units.

VETERINARY MEDICINE

Program Administrator: Professor L. M. Jones

Program Office: 131 Veterinary Medicine Building, Urbana

392. **Special Problems.** Individual research on a special problem chosen after consultation with the instructor and department head. Prerequisite: Professional standing in veterinary curriculum. 1 to 3 hours. May be repeated to a maximum of 6 hours.

VETERINARY PATHOLOGY AND HYGIENE

Head of Department: Professor L. E. Hanson

Department Office: 57 Veterinary Medicine Building, Urbana

330. **Veterinary Medical History and Orientation.** Introduction to the history, recent developments, scope, and trends of veterinary medical education, practice, research, public health, and other areas; functions, obligations, and organization of the profession. Prerequisite: First-year standing in veterinary curriculum. 1 hour.
331. **Veterinary Bacteriology.** Study of the properties of bacteria responsible for diseases of domestic and wild animals; special emphasis on transmission, propagation, pathogenesis, and diagnosis. Prerequisite: First-year standing in veterinary curriculum or consent of instructor. 5 hours.
332. **Veterinary Microbiology and Immunology.** Same as Veterinary Medical Science 332. Lectures, discussions, and laboratories dealing with mechanisms of infection and resis-

- tance; the properties, pathogenesis, and control of viral infections of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or consent of instructor. 4 hours.
333. **Protozoan and Arthropod Parasites.** Same as Veterinary Medical Science 333. Protozoan and arthropod parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
334. **General Pathology.** Same as Veterinary Medical Science 334. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, and inflammation and neoplasms; lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
335. **Special Pathology.** Same as Veterinary Medical Science 335. Disease processes affecting organs and anatomic systems and those occurring in specific diseases; lectures, quizzes, demonstrations, and laboratory. Required in veterinary curriculum. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
336. **Helminth Parasites.** Same as Veterinary Medical Science 336. Helminth parasites affecting domestic animals and man; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours.
338. **Clinical Pathology.** Discussion of the function and interpretation of hematological, parasitological, chemical, and certain other procedures as aids in the diagnosis of animal diseases; emphasis on the correlation of laboratory findings with fundamental changes and clinical manifestations of disease. Prerequisite: Third-year standing in veterinary curriculum. 2 hours.
340. **Diseases of Poultry.** The causes, symptoms, lesions, prevention, and treatment of non-infectious and infectious diseases of domestic birds; lectures, quizzes, and PLATO demonstrations. Prerequisite: Third or fourth year standing in veterinary curriculum or consent of instructor. 2 hours.
341. **Food Hygiene and Public Health.** General principles of antemortem and postmortem inspection of food animals; procedures and techniques used in the inspection of food of animal origin; diseases of animals transmissible to man; introduction to public health and public health administration; and principles of epidemiology. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 4 hours.
346. **Management and Diseases of Laboratory Animals.** Same as Veterinary Medical Science 346. Principles of management of conventional and gnotobiotic laboratories; emphasis on proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 2 hours or $\frac{1}{2}$ unit.
347. **Veterinary Clinical Oncology.** Same as Veterinary Clinical Medicine 347. Current techniques in diagnosis and treatment of neoplastic diseases of domesticated animals, including chemotherapy, immunotherapy, radiotherapy, and surgery; concepts of oncogenesis and tumor immunology; and incidence, breed and site predilections, behavior, prognosis, radiographic and other clinical features and complications of general classes and specific types of neoplasms. Prerequisite: Third-year standing in veterinary medical curriculum. 2 hours.
374. **General Epidemiology.** Same as Environmental Studies, Health Education, Medical Sciences, and Veterinary Medical Science 374. The epidemiology and natural history of infectious and noninfectious diseases, including integrated vector control and host resistance, and mental health and public health. Prerequisite: Microbiology 326, Veterinary Medical Science 332, or equivalent, or consent of instructor. 4 hours or 1 unit.
378. **Veterinary Clinical Orientation.** Same as Veterinary Biological Structure, Veterinary Clinical Medicine, and Veterinary Physiology and Pharmacology 378. Lectures and demonstrations illustrating the interrelationships between the basic sciences and their applications in medicine and surgery; includes methods of restraint and handling of

several animal species. Prerequisite: First-year standing in the veterinary curriculum. 1 hour.

VETERINARY PHYSIOLOGY AND PHARMACOLOGY

Acting Head of Department: Professor A. R. Twardock

Department Office: 263 Veterinary Medicine Building, Urbana

A proposal is currently under consideration to combine this department with the Department of Veterinary Biological Structure to form a Department of Veterinary Anatomy, Physiology, and Pharmacology.

- 202. **Physiology of Domestic Animals.** Lectures, quizzes, and demonstrations. Prerequisite: Chemistry 101 or 102, or equivalent. 3 hours.
- 315. **Veterinary Physiology.** Same as Veterinary Medical Science 315. Nervous and muscular systems, respiration, acid-base balance, urine formation, and body fluids and their regulation; lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours.
- 316. **Veterinary Physiology and Pharmacology.** Same as Veterinary Medical Science 316. Blood and lymph circulation, digestion, metabolism, and endocrine systems; lectures, discussions, and laboratory. Required in veterinary curriculum. Prerequisite: Veterinary Physiology and Pharmacology 315 or consent of instructor. 4 hours.
- 317. **Veterinary Clinical Pharmacology.** Lecture and discussion dealing with drug absorption and elimination, dosage regimens in health and disease, drug reactions and interactions, and the clinical trial. Prerequisite: Veterinary Physiology and Pharmacology 320 or consent of instructor. 1 hour.
- 318. **Pharmacology.** Same as Veterinary Medical Science 318. General principles of pharmacology and an analysis of the action of chemical agents on physiological processes; lectures, discussions, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 4 hours.
- 319. **Clinical Electrocardiography.** Lecture-discussion on clinical electrocardiography in veterinary medicine; discusses basic principles of cardiac electrophysiology, techniques of recording and interpreting electrocardiograms, and electrocardiographic recognition of cardiac enlargement, electrolyte imbalances, and arrhythmias; and emphasizes arrhythmias. Prerequisite: Fourth-year standing in veterinary curriculum and consent of instructor. 1 hour.
- 320. **Pharmacology and Toxicology.** Same as Veterinary Medical Science 320. Principles of drug action and an analysis of the action of chemical agents on living organisms, including intoxications of domestic animals. Lectures and laboratory. Prerequisite: Veterinary Physiology and Pharmacology 318 or consent of instructor. 4 hours.
- 321. **Topics in Veterinary Cardiology.** Lecture-discussion on topics in veterinary cardiology; major topics include congestive heart failure, congenital heart disease, acquired valvular disease, canine dirofilariasis, and cardiac surgery. Each topic is discussed from the standpoint of methods of diagnosis (emphasis on auscultatory diagnosis wherever appropriate) and treatment or management. Prerequisite: Fourth-year standing in veterinary curriculum and consent of instructor. 1 hour.
- 324. **Nutritional Aspects of Large Animal Medicine.** Clinical aspects of nutritional deficiencies, imbalances, and toxicities in cattle, horses, and swine; presentation of therapeutic principles; and nutritional aspects of the etiology, prevention, and treatment of specific disease conditions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours.

326. **Nutritional Aspects of Small Animal Medicine.** Clinical aspects of nutritional deficiencies, imbalances, and toxicities in small animals; presentation of therapeutic principles; and nutritional aspects of the etiology, prevention, and treatment of specific disease conditions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 1 hour.
367. **Radiology and Radiobiology.** Same as Veterinary Clinical Medicine 367. General principles of radiology and radiobiology including techniques and application to the diagnosis and therapy of animal diseases; lectures, discussions and laboratories. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 3 hours.
378. **Veterinary Clinical Orientation.** Same as Veterinary Biological Structure, Veterinary Clinical Medicine, and Veterinary Pathology and Hygiene 378. Lectures and demonstrations illustrating the interrelationships between the basic sciences and their applications in medicine and surgery; includes methods of restraint and handling of several animal species. Prerequisite: First-year standing in the veterinary curriculum. 1 hour.

VOCATIONAL AND TECHNICAL EDUCATION

Chairperson of Department: Professor L. J. Phipps
Department Office: 345 Education Building, Urbana

101. **Nature of the Teaching Profession.** Introduction to educational problems; a general study of the nature of teaching: its opportunities and responsibilities. Through individual work, students are helped to evaluate their potentialities for teaching. 2 hours.
181. **Introductory Woodwork.** Beginning course in hand woodwork, with emphasis on both manipulative skills and related technical material. One section of this course is offered for majors in industrial education and another for students in the occupational therapy curriculum. 4 hours.
182. **Advanced Course in Woodwork.** Advanced course in design and construction of woodwork projects with related technical information. Prerequisite: Vocational and Technical Education 181. 4 hours.
183. **General Metalwork.** A basic course in general metalwork; materials, tools, problems, and processes in bench metalwork, foundry, and introductory gas and arc welding. 4 hours.
188. **General Shop for Elementary and Special Education Teachers.** Includes manipulative processes and the study of tools and materials appropriate for craft and shop activities in the elementary school and in special education classes. 3 hours.
189. **Supervised Occupational Experience.** Provides students preparing to teach in the vocational and technical fields the occupational experience necessary or appropriate to complete the requirements in these curricula. Students who are employed and concurrently enrolled in this course complete assignments covering the related technical information of their chosen fields and undergo regularly scheduled written, oral, and performance examinations. Application for a job assignment must be made three months prior to the semester in which placement is desired. Prerequisite: Sophomore standing. 2 or 3 hours. May be repeated to a maximum of 17 hours.
199. **Undergraduate Open Seminar.** 1 to 5 hours. May be repeated.
240. **Principles of Vocational and Technical Education.** Provides each specialized educational worker with a common orientation as to the major responsibilities of the public school as a unit and to the educational worker's own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Vocational and Technical Education 101; Psychology 100. 2 to 4 hours.
249. **Independent Study.** Permits study of problems not considered in other courses; designed for students who excel in self-direction and intellectual curiosity. Prerequisite:

Upperclassman; upper five percent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

270. **Technique and Curriculum Development for Teaching Secretarial and Office Practice Subjects.** Review of results of current research and experimentation in the teaching of typewriting, shorthand, and other office practice subjects; review of basic education principles relative to skill development; and introduction to the use of innovations and technology, and their implications for office education. Proficiency level in typewriting and shorthand must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.
271. **Technique and Curriculum Development for Teaching Data Processing and Office Machines.** Introduction of techniques for teaching the operation of a variety of office machines used for processing data; introduction of current methods of teaching the use of automated data-processing equipment and requirements for employment. Proficiency level in the operation and theory of operation of office machines used for processing data must be validated through examination administered by business education faculty prior to enrollment in the course. 3 hours.
275. **Summer Experience in Agricultural Education.** Supervised experience in the work of a teacher of agricultural occupations during a two- or three-week period in the summer; planning summer work, teaching adult classes, supervising farm practice or on-the-job training of students, advising school-sponsored youth organizations, counseling students, studying a community, becoming acquainted with facilities and equipment used in an agricultural occupations program, and becoming familiar with the situations in which the student will later do student teaching during a school year. Course work is completed during the summer with official registration in the fall semester. Prerequisite: Educational Policy Studies 201. 2 or 3 hours.
276. **Student Teaching in Agricultural Occupations.** Supervised experience in the work of a teacher of agricultural occupations during an eight-week period; planning programs, teaching high school and adult students, managing facilities and equipment, supervising students on the job, advising youth organizations, counseling students, and keeping records and making reports. Prerequisite: Educational Policy Studies 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 277. 8 hours.
277. **Programs and Procedures in Agricultural Education.** Preparation for a successful experience in student teaching and for beginning work as a teacher of agricultural occupations; teaching high school and adult classes, maintaining and using facilities and equipment, supervising occupational experience programs, advising youth organizations, counseling students, and keeping records and making reports. Prerequisite: Educational Policy Studies 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 276. 5 hours.
278. **Vocational Home Economics Education for Youth and Adults.** Preparation for work as a teacher in vocational home economics programs for youth and adults; study of procedures for planning, organizing, executing, and evaluating home economics occupational programs. Prerequisite: Senior standing and consent of instructor. 3 hours.
280. **General Drafting for Teachers.** An integrating course to prepare industrial education students to teach drafting; deals primarily with the problems of organizing and teaching drafting courses. 3 hours.
284. **Advanced Metalwork.** Intermediate and advanced operations with hand and machine tools; the designing, planning, and constructing of machine shop projects; and a study of ferrous and nonferrous materials appropriate for machine shop work. Prerequisite: Vocational and Technical Education 183. 4 hours.
291. **Thesis.** Prerequisite: Senior standing. 2 hours.
292. **Thesis.** Prerequisite: Senior standing. 2 hours.
349. **Special Study and Investigation in Vocational and Technical Education.** Offers opportunity for an individual to study, on or off campus, selected problems, trends, and

new developments or to conduct specialized technological investigations for the improvement of instructional programs in areas related to vocational and technical education. Prerequisite: Consent of instructor; demonstrated ability to pursue special study or investigation proposed. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

370. **Agricultural Education for First-Year Teachers.** Specific help with the problems of beginning teachers; campus meeting in August; other meetings in centers in the state convenient to first-year teachers; and visits by instructors to schools in which first-year teachers are employed. Prerequisite: Vocational and Technical Education 276 and 277. 3 hours, or $\frac{3}{4}$ to 1 unit.
381. **Foundations of Career, Occupational, and Practical Arts Education.** A study of basic concepts and practices of career, occupational, and practical arts education; explores the development of the curricular areas concerned, including types of programs, their place and role in various types of educational settings, students served, and issues and trends in program change. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
382. **Cooperative Vocational and Technical Education Programs.** Provides the specific professional background required of teachers, coordinators, and administrators who organize and conduct public school programs utilizing community resources and experiences; includes the background, philosophy, organization, and administration of cooperative education. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
383. **Planning and Organizing Content for Career, Occupational, and Practical Arts Education.** Emphasizes selection, organization, and preparation of content for instructional programs in career, occupational, and practical arts education; students perform task analyses, prepare instructional objectives, arrange content in appropriate sequence, and determine allocation of resources. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
384. **The General Shop Program.** A laboratory and theory course in the organization and administration of the industrial arts general shop program. Prerequisite: Sixteen hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.
385. **Problems in Concurrent Work-Education.** While employed in approved cooperating business firms, students observe the relationships between their activities and the specialized educational programs in the high school and community college; in class sessions, emphasis on job analysis, current trends, wage and benefit structure, personnel practices, labor relations, and their implications for teaching. Prerequisite: Completion of prescribed courses in vocational and technical education for teaching in their area of specialization; consent of instructor. 4 hours or 1 unit.
387. **Training Programs in Industry.** Study of the organization, instruction, supervision, and evaluation of training programs conducted within industry and their relationships to other educational agencies. 4 hours or 1 unit.
388. **Special Techniques of Teaching Career, Occupational, and Practical Arts Education.** A study of teaching techniques appropriate to career, occupational, and practical arts education; focuses on communication methods and instructional strategies; students conduct investigations, develop materials, and make applications to their areas of concern. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.
399. **Issues and Developments in Vocational and Technical Education.** A special course for experimentation or for seminar on topics not treated by regularly scheduled courses; requests for initiation of this course may be made by students or faculty members. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 8 hours or 2 units.
442. **The Community College.** Same as Administration, Higher, and Continuing Education 442. Community colleges and vocational-technical institutes: their purposes, function, and objectives; social forces related to their development and evaluation; characteristics and needs of students; educational programs and teaching strategies; and organization, control, and financing. 1 unit.
445. **Investment in Human Resources.** Same as Labor and Industrial Relations 445. Activities which influence future monetary and psychic income by improving the resources in people; investments include schooling, on-the-job training, medical care, migration,

and the search for information on prices and incomes, with main emphasis on education. A last section covers educational planning. Prerequisite: An introductory course in economics and in quantitative methods. 1 unit.

448. **Continuing Education Program Development.** Same as Administration, Higher, and Continuing Education 448 and Secondary Education 448. Analysis of the process of planning and conducting continuing education programs for adults; includes theory, research, and practice regarding sponsors, need appraisal, objectives, selection and organization of learning activities, and evaluation. Recommended for majors in continuing education. Prerequisite: Consent of instructor. Administration, Higher, and Continuing Education 362 is recommended, especially for majors in continuing education. 1 unit.
449. **Independent Study.** Offers opportunity and challenge of self-directive, independent study, that is, develops the individual's ability as an independent student and enables the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. Prerequisite: Approval of study outline by adviser and the department chairman prior to enrollment. $\frac{1}{2}$ or 1 unit. No more than 2 units may be offered toward an advanced degree except by consent of the dean of the College of Education.
450. **Evaluation in Vocational, Technical, and Practical Arts Education.** Theory and techniques of evaluation in cognitive, affective, and psychomotor domains at different educational levels; includes development and analysis of activities and instruments for student and program evaluation, follow-up studies, and interpretation of results of self-evaluation for administrative decision making. 1 unit.
451. **Directing Personnel Development in Vocational, Technical, and Practical Arts Education.** Principles and techniques for development of personnel in programs of vocational, technical, and practical arts education; emphasis on personnel development and instructional supervision of paraprofessionals, employers, and foremen of vocational and technical education students. Prerequisite: One unit in vocational and technical education or consent of instructor. 1 unit.
453. **Problems in Home Economics Education.** Prepares consumers of research through a comprehensive study and 6.evaluation of home economics investigations now available and through the experience of carrying out an individual investigation of limited scope. 1 unit.
456. **Problems and Trends in Specialized Fields of Vocational and Technical Education.** Introduction to significant problems, points of view, and trends in the field concerned; explores significant research relating to organization, content, and techniques in the field in question. Students are encouraged to make special studies in approved areas. 1 unit.
459. **Workshop in Curriculum Development.** Curriculum development projects in the specialized fields of agriculture, business, home economics, health, and industry. $\frac{1}{2}$ to 2 units.
471. **Policy and Program Development in Vocational, Technical, and Practical Arts Education.** Local, state, and national policies for vocational and technical education; organizing for policy making and program development; and developing desirable policies and programs. 1 unit.
472. **Course Planning and Teaching Procedures in Agricultural Occupations Programs.** Gathering data essential in course planning, constructing course plans, and developing resource units, teaching procedures, and instructional aids. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{3}{4}$ to 1 unit.
473. **Vocational Education in Agriculture for Adults.** The case for adult education, needs of young and adult farmers for education, development and present status of adult education in agriculture, objectives, evaluation, using advisory committees, organizing adult classes, enrolling students, course planning, teaching procedures and aids, supervised practice, group activities, and facilities. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{3}{4}$ to 1 unit.

474. **Supervised Experience in Agricultural Occupations Programs.** Supervised agricultural experience programs as an educational strategy; importance and meaning of supervised agriculture experiences; planning, conducting, supervising, and evaluating agriculture experience programs; relation of supervised agriculture experience programs to establishment and advancement in an occupation; keeping and using records; and relating class instruction to supervised agriculture experience programs. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{3}{4}$ to 1 unit.
475. **Organizing and Teaching Agricultural Mechanics.** Agriculture mechanics as a phase of vocational education in agriculture; purposes, course planning for high school students, young farmers, and adults; methods of teaching and evaluating on-farm or on-job instruction; planning agriculture-mechanics shops and facilities; and providing and teaching safety in agriculture mechanics. Prerequisite: Vocational and Technical Education 276 and 277, or consent of instructor. $\frac{3}{4}$ to 1 unit.
476. **Guidance in Vocational, Technical, and Practical Arts Education.** The guidance function of a vocational or technical teacher; identifying and selecting students for vocational and technical programs; determining manpower and job requirements; providing occupational information; placing graduates; counseling parents, students, foremen, advisory committee members, union members, and employers; and conducting follow-up studies. 1 unit.
481. **History and Basic Concepts of Vocational and Technical Education.** The historical development of modern vocational education; the educational theories underlying its development; and the educational concepts upon which present programs and procedures are based. 1 unit.
482. **Research Studies in Vocational and Technical Education.** Study and evaluation of examples of research in this field; consideration of the research needed to solve present problems. Each student proposes and completes a brief research project, or plans in detail a major research project to be completed later. 1 unit.
487. **Seminar in Vocational, Technical, and Practical Arts Education.** Overview and interpretation of social, economic, and technological trends which have relevance to the problem of developing new programs in the vocational, technical, and practical arts areas; analysis and evaluation of innovations in the field; and current issues and problems. Prerequisite: Graduate standing in vocational and technical education. 1 unit.
488. **Curriculum Problems and Trends in Industrial Education.** Selection and organization of instructional materials for industrial courses; study of basic concepts underlying course construction in industrial education. Prerequisite: Undergraduate work in appropriate vocational and technical education courses. 1 unit.
489. **Administration of Vocational and Technical Education.** Problems and approved practices in the administration and supervision of programs of vocational, technical, and practical arts education in secondary schools, junior colleges, and technical institutes. Prerequisite: Consent of instructor. 1 unit.
490. **Seminar for Advanced Students of Education.** Seminar in vocational and technical education open only to persons who have been admitted for doctoral study in vocational and technical education; sections are usually offered in the following areas: (a) industrial education, (b) agricultural education, (c) home economics education, (d) business education, and (e) general vocational and technical education. 1 to 2 units.
491. **Field Study and Thesis Seminar.** Assists doctoral candidates in planning field studies and thesis problems; students present their studies at each of four stages: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; and (4) the final design stage. Students are expected to analyze critically all presentations. Limited to students who have been admitted for doctoral study. 1 to 2 units.
499. **Thesis Research.** Individual direction of research and thesis writing. 0 to 4 units.

YORUBA

(See Linguistics under Humanities, School of)

ZOOLOGY

(See Life Sciences)

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Additional Information

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The *Undergraduate Programs* catalog is available for reference at high schools, community colleges, and public libraries in the state of Illinois. Individual copies of the catalog may be purchased for \$1 at the Illini Union Bookstore and the Main Desk of the Illini Union, or ordered by mail for \$2 from the Illini Union Bookstore, 715 South Wright Street, Champaign 61820. The *Graduate Programs* catalog is available for reference at university and college libraries.

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Institute of Labor

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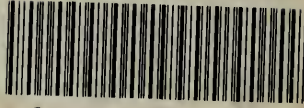
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